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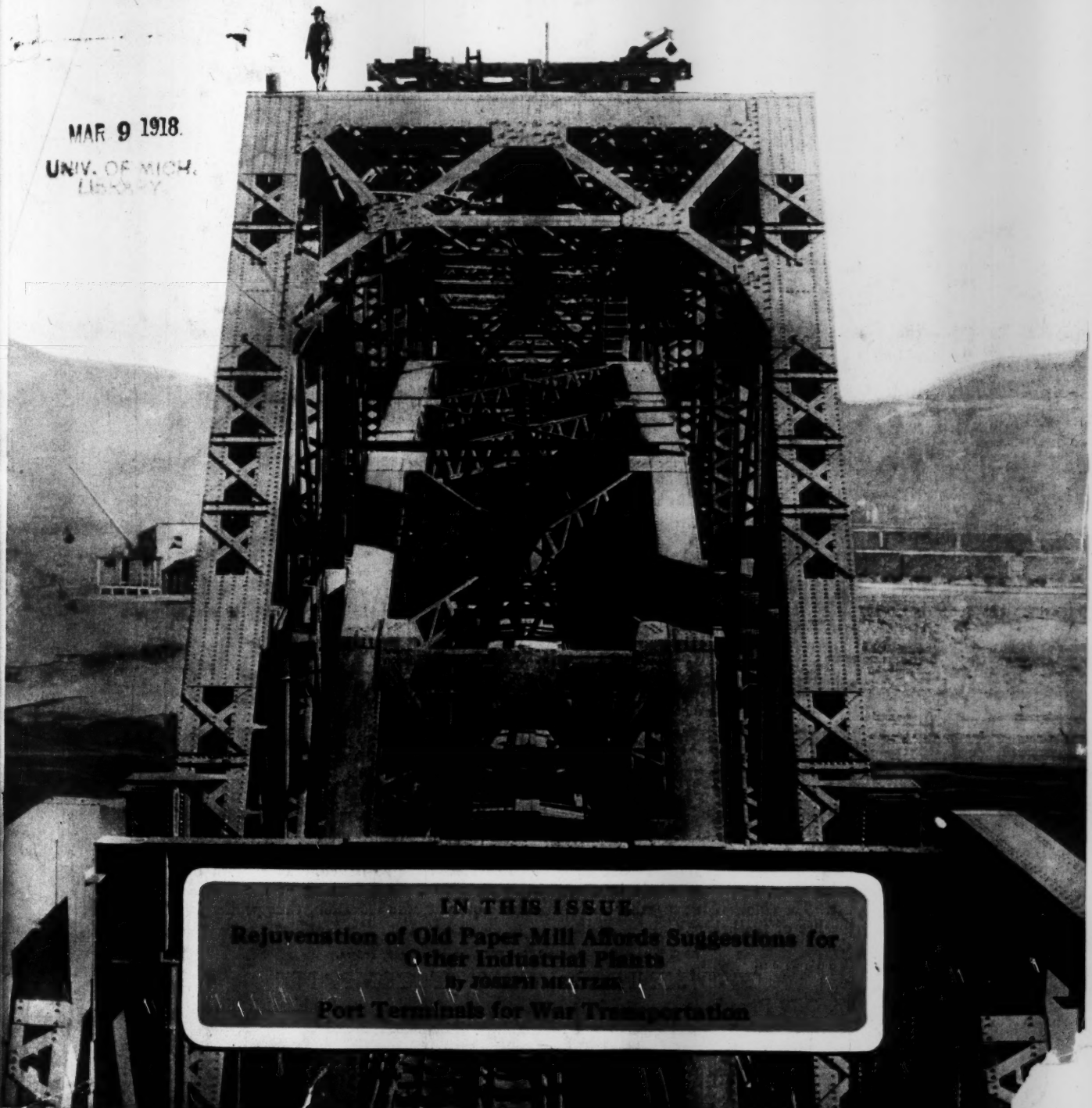

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By JOSEPH METZEN

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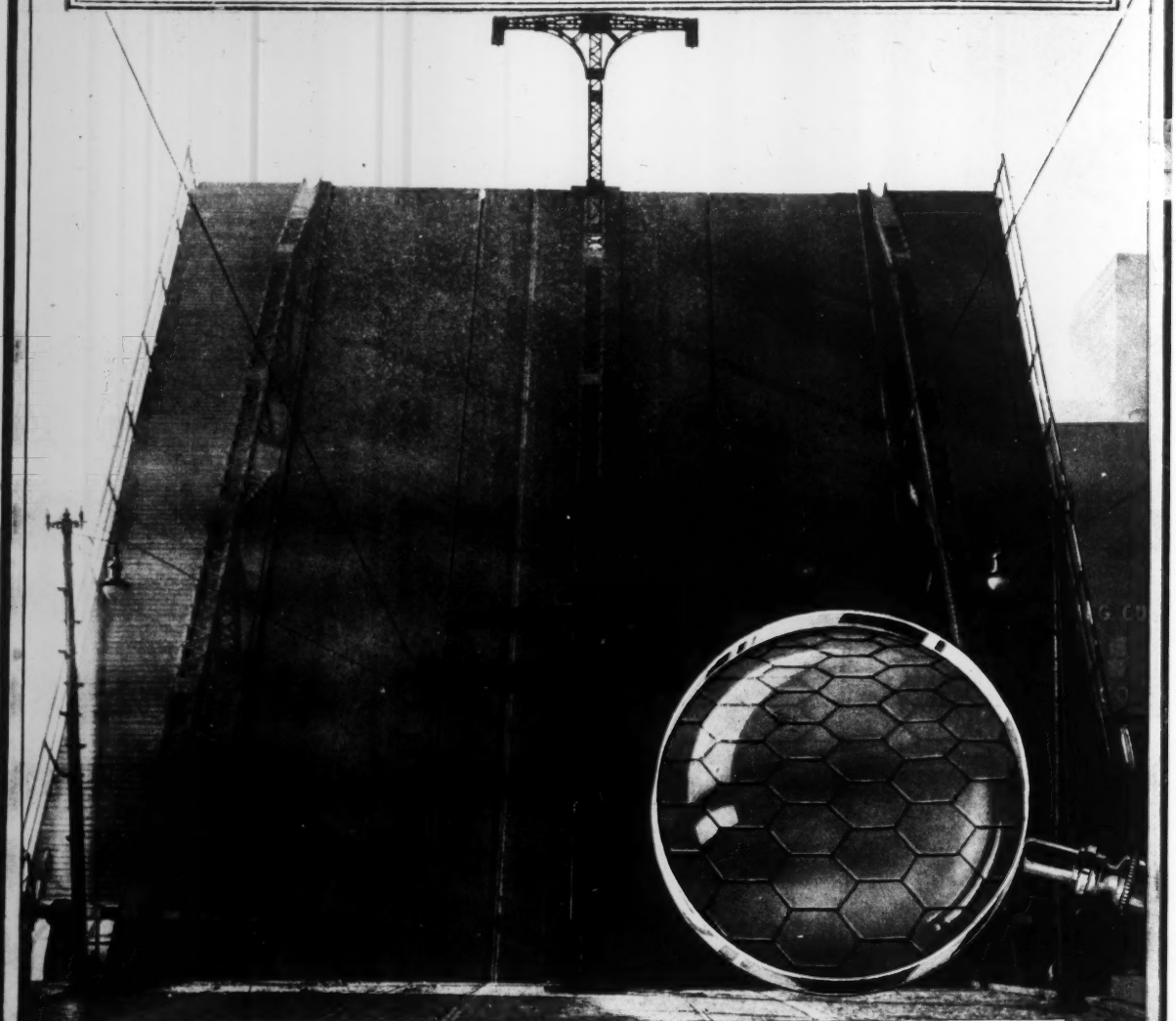
WOOD BLOCK FLOORS *Best for Bridges*



Kreolite Hex Wood Blocks on Randolph St. Bridge

Chicago specified Kreolite Hex Blocks for the Randolph Street Bridge because of their extreme durability under the heaviest traffic; the Hex shape also provides for the destructive thrust of expansion and bulging. Each block is 90% heart wood, which permits face nailing to the subplanking with 20d wire nails through the heart of the block without splitting. About 25% of these blocks are so nailed. This, with the pitch filler, binds the whole in a monolithic mass to the subplanking of the Bascule lift. Hex blocks knit together under use and absorb traffic vibration, thus prolonging the life of the bridge.

50% of orders received in 1917 were repeat orders.

THE JENNISON-WRIGHT COMPANY

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
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AND CONTRACTING

E. J. MEHREN, Editor — CHARLES WHITING BAKER, Consulting Editor

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"The Old Order Changeth"

PRINCIPLES of individual rights lie at the very bottom of the civilization developed by the English speaking peoples. Our advance in commerce and technological industry seems inextricably bound up with the development and perfection of these conceptions of liberty, though any precise valuation of these influences is difficult, if not altogether impossible. The least that may be said is that they have stimulated individual initiative; and, in the absence of a community consciousness, were the main factors contributory to the unique growth of the machine industries in England and America.

But each organism contains within itself the germ of its own decay. Laws as derivatives of human activity must also ultimately exhibit signs of decrepitude, of an inherent and growing inability to meet conditions. So no fault should be found with the logic underlying the belief that immutable, natural laws governed human relationships—except that modern social studies and today's experiences show that if the laws had *once* been natural, they were not, therefore, immutable, and that human relationships have been so altered by the working of these laws that the laws themselves are no longer applicable. Since society has fostered the changes wrought by these laws to such a point that "freedom of contract"—based upon an assumption of equality between employer and workman—is no longer possible because of the obviously superior strategic position of aggregated capital, society must look for other methods of maintaining and regulating individual freedom. For it should be apparent that today the worker neither owns the tools upon which he must depend for his livelihood, nor can he find frontier lands where the tools needed are of the simplest and most easily secured. He must either accept the terms of the owner of the tools he must use, or else band with his fellows to regain the equivalent of his former individual bargaining strength.

A goodly number of employers have recognized the disadvantage of the position in which the worker now finds himself. In this recognition there is not necessarily any feeling of justice. On the other hand the conversion of the employer of this class is founded in the certainty that more harm than good inevitably follows an obstinate refusal to treat of wages and hours on a basis approximating equality. Experience has taught that a strike won may mean profit lost through ca' canny or sabotage, while treatment considered fair by the workers usually brings an increase in production which makes up the loss due to wage increases or shortened hours. Running contrary to these employers are groups, fortunately diminishing in number but still in the majority, which seem to consider any concession to the demands of the laborers as tribute, than which they would rather spend millions in defense. These have the support of the tradition and word of the law, as well as the spirit read into the law by the courts.

The history of the many attempts to legislate in favor of labor furnishes the occasion for a recent bulletin (No. 229), of the Department of Labor. One at all in touch—and that implies a certain sympathy—with the recent trend of thought on these matters will be surprised at the consistent conservatism which has characterized judicial decisions during the last three decades of this country's history, and which is made so evident by the purposeful grouping of fact found in this bulletin. In attempting to find a reason for the blindness of the courts toward the conditions existing in industry, there is satisfaction only in the realization that the traditions of the courts are against the consideration of data of an *ex parte* nature, and that in addition the judges have no machinery whereby they can determine such matters for themselves. As a result decisions are in the main dictated by consideration of theory alone—and a theory, furthermore, which had its origin in the much simpler industrialism of the 17th Century.

This failure on the part of the courts to keep in touch with the movement of the 20th Century should be a matter of grave public concern, for custom as well as law places the police power in the hands of the judiciary, and a stubborn employer, backed by a conservative court and an unthinking police, might at any moment plunge the country into the destruction of a social revolution.

Fortunately such a crisis, however imminent and possible it may be, is for the moment rendered improbable through the circumstance that the principal industries are working on munitions under federal administrative control. And patriotism is another factor working for immediate industrial peace.

But imagine for a moment such a blocking of the transportation system that factories would be forced to shut down through a stoppage of the supply of raw materials. Consider the added effect of a shortage of the food supply due to the same cause. Would labor, particularly the organized trades, be content with the explanations of a press which they consider capitalistic? Is there not more than a chance that the enforced idleness and the inevitable hunger would give the professional agitator the very opportunity he has been awaiting? The phrase "another capitalistic trick" would come easily to his tongue and would fall on ready ears. The memory of many wrongs is accented by adversity.

There are rumors even now of a complete and imminent breakdown of the transportation system, and a not altogether ungrounded fear that the spring and

winter wheat crops will prove inadequate to the actual needs of the country. Nor is Gompers so securely in the saddle that he can unqualifiedly and with certainty pledge the support of even the American Federation of Labor—which is only a fraction of American labor.

So it would appear that the committee now considering a national labor program has the opportunity of accomplishing more than a stark basis of agreement between capital and labor, to hold only for the duration of the war. Composed as the committee is of representatives of the public as well as of the parties in conflict, and with the Government and the people aware of the critical nature of their deliberations, small chance remains of chicanery or concealment of issues. Furthermore, the committee is not bound by age-old legal traditions, and comes to its task with a realization that prejudices of class and creed would be in sorry taste. Granted time and reasonable fortune, the issuing program cannot fail to include a recognition of fact, as it is, which will diminish if not altogether eliminate antiquated judicial attitudes.

Capital has consistently opposed what it considers the aggression of labor, partly through a fear based on ignorance. A fair trial of modern managerial methods will remove from the courts a class of cases for which the courts were not designed.

Official Recognition of the Concrete Ship

IN THE matter of concrete ships it would appear that the Shipping Board is making material progress. The Senate committee that is investigating the shipping situation passed a resolution on Jan. 29 urging a thorough study of the availability of concrete for ocean-going vessels, just one month after the board had organized its Department of Concrete Ship Construction for that very purpose. This forehandedness may be surprising to many besides the Senate committee. The concrete-ship idea has indeed been adequately presented to the American public, both lay and technical; but aside from a few who were working close to it there has not been an appreciation of the extent to which the idea has materialized. The pictures of the big San Francisco ship in these pages some weeks ago gave one indication of how far the idea's development has gone. The Shipping Board's activities as told in this issue make sure that this new type of marine construction will have every chance to show its worth. Certainly no more thorough consideration of the merits of a new and possibly valuable idea could be given than the Shipping Board means to accord the concrete ship. Many engineers think the conception visionary; as many others, equally competent, are convinced of its worth. With the expert ability of the Shipping Board's department bent to this special task of proving or discarding the concrete ship once for all during this war, we may reasonably hope by early summer for some knowledge not only based on theory but backed by actual tests of large ships at sea.

Pay of Railroad Civil Engineers Proper to Discuss

FOLLOWING the lead of the American Association of Engineers, the Engineering Council has submitted to the Railroad Wage Commission an argument, set forth on page 465 of this issue, for better pay for railroad civil engineers. There was ample occasion for such an argument. So comprehensive and irresistible have been the demands of organized railroad labor that there has been little left for the unorganized men of the engineering departments, and they have received little recognition of the increased cost of living. The time is nearing, it is hoped, when the profession will not have to plead its own cause. Probably there will have to be derived a new definition of an engineer, which will exclude many draftsmen and field men who do their present work well but lack the equipment for advancement to a higher order of engineering—men who, in fact, look on their work as a trade, and who must depend on unionism, as do the men in other trades, for advancement as to pay. Under present conditions, however, few of the railroads differentiate between these men and the young graduates who have the makings of real engineering executives, or the older men who are technically strong and highly valuable for their individual efforts, though not qualified to direct others. And with the scale of pay for the men in the ranks set by those destined not to rise very high, it is natural that the resident engineers, assistant engineers and even division engineers should also fare poorly. We do not meet the situation by saying that if these men are capable they can find adequate recognition in other lines. Young men go into railroad service in good faith, properly willing to take small pay for a while, and by the time they realize the true conditions they are likely to have family responsibilities that bar them from taking chances on a change. Aside from that, railroad civil engineering is highly important, and good men are needed in this service. The efforts of the American Association of Engineers and the Engineering Council to keep them there are therefore highly to be commended.

Progress with Cast-Iron Pipe Specifications

MEASURABLE progress in the revision of cast-iron pipe specifications by committees of the American and the New England water-works associations may soon be expected. It is hoped that replies to the questionnaire authorized by the New England association Jan. 9 will be received and summarized in time for presentation at the meeting in Boston on Mar. 13. Presumably, the results of a similar questionnaire will be submitted at the St. Louis convention of the American association, two months later. A ten to one vote in favor of revision of some kind may reasonably be expected—if for no other reason, in order that the two "standard" specifications may be made into one real standard, now that the minds of the majority members of each committee have met. Of the three other questions at issue, the one asking members whether they favor the adoption of a uniform outside diameter can readily be answered yes or no by any experienced water-works engineer or superintendent. The third and fourth questions—on the desirability of specifying chemical requirements and breaking load should be specified—are technical; of metal, and as to whether a relation between flexure

but the opinions of the membership on these subjects should be of value to the committee. It should be remembered that all three mooted questions relate to points in a tentative draft of specifications, and that there is no intention of changing the specifications until a reasonable period after the war has elapsed. The results of the questionnaire promise to be a guide to the committees of the two associations. Such a referendum is in line with the growing democratic spirit of the day.

Pennsylvania Report Brings Up Question of Free Vertical Motion of Rails

IN RAILWAY track construction is the rail to be considered as an independent unit supported by but not fastened to the ties? Or are the rails and ties to be so securely fastened together as to form one compound unit? In other words, should rail fastenings permit free vertical movement of the rail in the wave motion or undulation under traffic? And as a specific question, should spikes be left with their heads clear of the rail base so that they have the function only of preventing lateral displacement of the rails?

These questions are raised by the recent revival of an old theory to the effect that the spike should be regarded as a guide or stop rather than as a fastening. This theory is still held by some engineers of extended experience, though it is rarely carried into practice. Today the almost universal idea in the design and application of spikes or other fastenings is that of holding the rail rigidly to the tie. In track work also it is almost universally held that as soon as fastenings begin to lift vertically and allow the rail free play they should be driven home.

One of the most interesting applications of the "loose-spike" or "loose-rail" idea was in a continuous-rail track construction tried on the Norfolk & Western Ry. in 1889. On a 3-mile length of track the rail joints were riveted up and the spike-heads were left ¾ in. clear above the rail base, so as to offer no restriction to the wave motion of the rails. There were no very conclusive results, this being a rather crude experiment on track having very light rails with ties embedded in an earth roadbed. It is recorded, however, that no lining or surfacing was done for 18 months, while on an adjacent 3-mile length of ordinary track the maintenance cost during the same period was $1890.

The question is brought up again by letters accompanying the recently published report of the Pennsylvania system's committee on screw-spike tests. In 1910, Joseph T. Richards, then chief engineer maintenance of way of the Pennsylvania R.R. and chairman of the committee, wrote as follows in a letter referring to the committee's work:

"From my own experience I believe that any form of construction that lacks elasticity to some degree, depending largely on the stiffness of the rail and the rise and fall of the wave of the rail, ahead of, under and following the passing wheel, will result in damaging the rail and roadbed, and also the rolling stock. I believe that we will save many accidents and much trouble and expense by a little elasticity in our roadbed, and that our experiments will show it to be economical to avoid the churning of the tie by leaving a small space between the upper surface of the base of the rail and the under side of the head of the screw spike."

It will be noted that Mr. Richards indicated stiffness in the rail and vertical churning or pumping motion of the ties in the ballast as factors to be taken into account. In the same letter he quoted a report from W. C. Cushing, chief engineer maintenance of way of the Southwest system, Pennsylvania lines west of Pittsburgh, in which was the following statement bearing upon this aspect of the problem: "I am a believer in stiff track as a necessary part of improved track construction which we must have absolutely to keep up with the increased weight of rolling stock. It should be our effort to reduce wave motion on the rail by having a stiffer rail and a better roadbed."

In 1915, A. C. Shand, chief engineer of the Pennsylvania R.R., wrote in regard to the screw-spike tests that he considered the spikes under test had not sufficient holding power in the wood, saying:

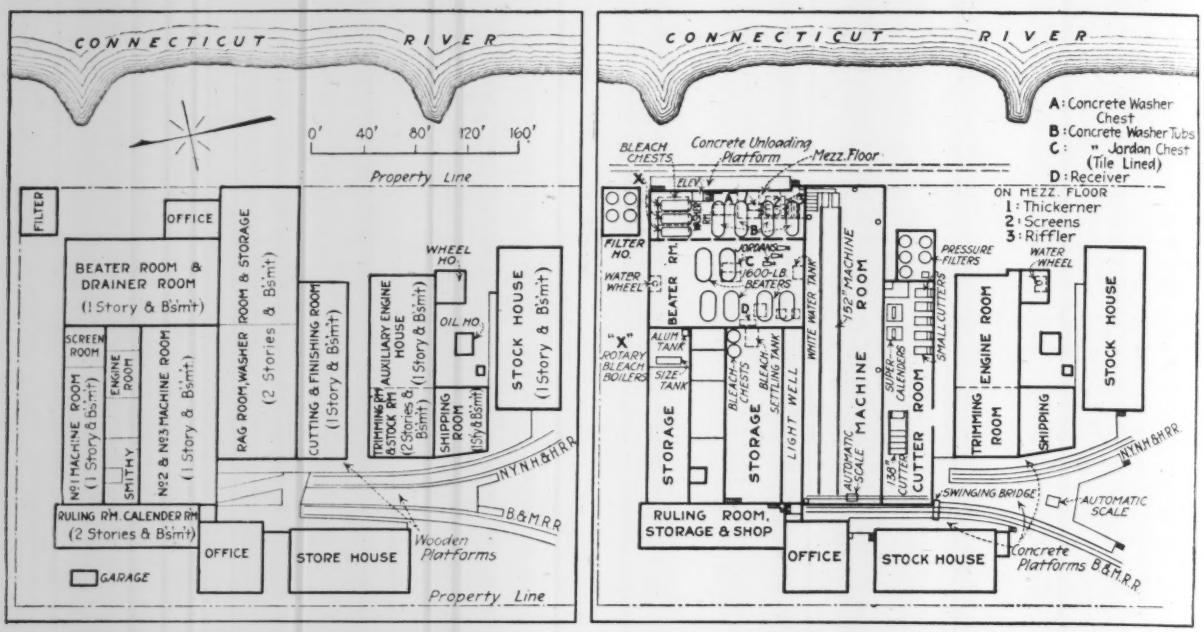
"My opinion is that no screw spike of any size, the under side of the head of which is brought closely in contact with the base of the rail, will remain in good condition for a considerable length of time. The under side of the head should be at least ¼ in. from touching the base of rail, otherwise the movement of the rail on the ties will naturally either loosen the spikes or raise and lower the cross-ties as the rolling stock passes."

This view was supported by F. T. Hatch, chief engineer of the Vandalia R.R., and a member of the committee. He pointed out that the constant vertical working of the tightly driven screw spike in the tie would destroy the fibers of the wood so that there would be no holding power.

These opinions in favor of leaving the screw spike clear of the rail were endorsed in 1915 by W. G. Coughlin, chief engineer maintenance of way of the Pennsylvania R.R., and chairman of the committee.

In theory, at least, the idea of the loose rail has some good grounds. These apply more particularly, however, where the rails are light and the traffic is heavy—a combination or condition which does not make for good or economical main track. In practice the idea leads to troubles. Vertical movement of the rail combined with lateral pressure tends to grind and cut the spike. Lateral pressure further tends to bend the spike and force it back into the wood, which tendency the spike can resist to better advantage if the head bears upon the rail base. It is true that these effects may be reduced by the use of tieplates having shoulders which take some of the pressure and friction and thus relieve the spike.

At the present time it is the most general opinion that the rails and ties should be rigidly held together. This applies particularly under the proper condition of track, where the rails are heavy in proportion to the loads and traffic imposed upon them, and where the wave motion may thus be relatively small. Experience with rigid fastenings under such conditions indicates that the wear of rail will be less than if the fastenings are loose. It seems, therefore, that in track design and construction, the aim should be, as Mr. Cushing states, to reduce wave motion by means of a stiffer rail and a better roadbed.



OLD AND NEW LAYOUTS OF AMERICAN WRITING PAPER COMPANY'S MILL AT HOLYOKE, MASS.

Old Paper Mill Rebuilt for Efficient Operation

Effect on Labor Also Considered—Solutions of Problems of Routing, Machinery, Structure and Fittings Applicable to Other Industrial Plants

BY JOSEPH MELTZER
Structural Engineer, Casper Ranger Construction Co., Holyoke, Mass.

NEW BUILDINGS just completed at Holyoke, Mass., for the American Writing Paper Co., replace the old mill which constituted the George C. Gill Paper Co. division. While the reconstruction of the plant was essentially a paper mill problem and is primarily interesting to engineers in that line of work, the adaptation of structure to purpose and the selection of fittings and materials are equally applicable to all kinds of industrial construction. In laying out the new mill the general aim was to provide structures which would give plenty of natural light without recourse to skylights, and embody such sanitary facilities as would help the employees and encourage them in a healthful way to put forth their best efforts, thus creating efficiency in both operation and production. Three primary objects were kept in the foreground in the new layout—first, to provide spacious rooms for the economical and rapid handling of raw stock and the finished product; second, to provide mechanical carriers such as cranes, trolleys and other devices for handling the finished product; third, to provide fireproof construction not only as a precaution against fire but to reduce repairs and to cut down deterioration.

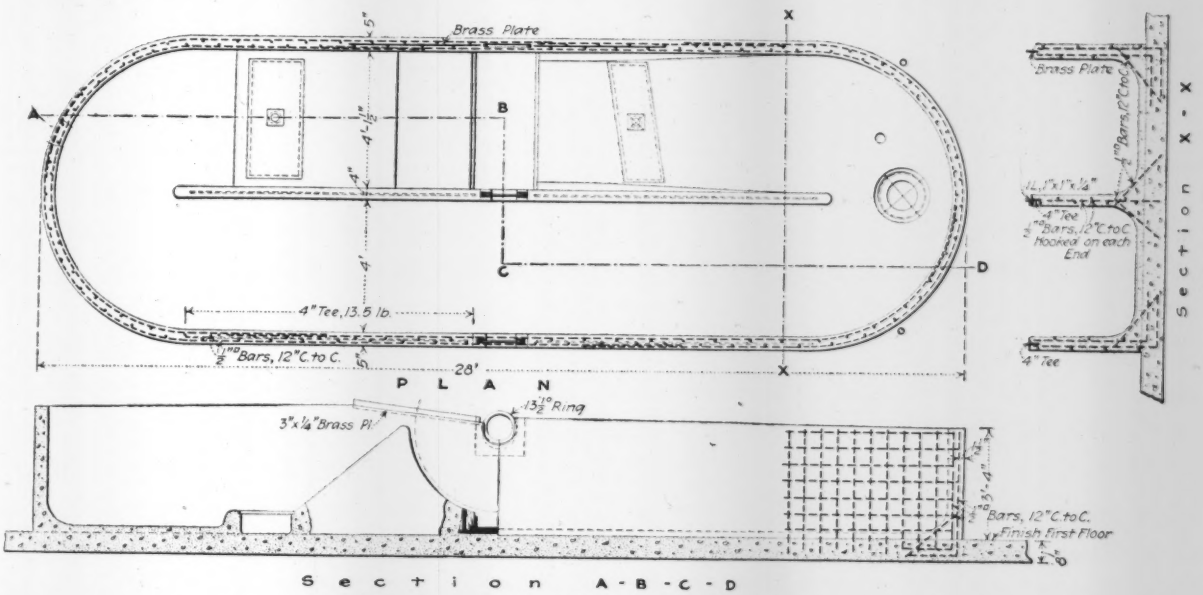
The work was undertaken in November, 1916, and the old mill was continued in operation until June, when all work was shut down had the old structures torn down to make room for the new buildings. The entire new mill is now in operation.

The old mill was not only behind the times in its mechanical equipment but was also structurally delapidated. It contained three paper machines of an old type which had become almost obsolete, owing to the rapid increase in the width of machines for the paper companies of the North and West. In normal times the small machines could not compete successfully with the large units. The general construction of the 35-year-old buildings was of brick laid in lime mortar, wooden beams, plank floors and high peaked, slated roofs. The recent condition compelled constant repairs to walls and floors, which had deteriorated not only from age but also from the excessive moisture and acids which the production of paper carries with it. Sanitary conditions were appalling. The basements were constantly wet, due to the discharge water from the machines, beaters and washers and the lack of proper drainage. The cramped location of all stuff chests and their inaccessibility made operation not only disagreeable but dangerous. The loading and unloading platforms, to which two railroads fed the incoming material, were in a state of delapidation which caused constant worry to the employees and made necessary frequent repairs.

Under the pressure of demand for production it was decided to reconstruct the buildings into a modern, up-to-the-minute book mill, installing a very large paper machine and the other necessary adjuncts in equipment to make it equal to the best mill in America. It must be noted here that in the old mill, due to lack of storage facilities, the beater room was sometimes utilized for storage. This made the operation of the machines very difficult and necessitated the employment of extra labor, adding excess cost to the handling of raw stock. Under

the prevailing market conditions for the past two years, the difficulty of getting raw stock and the advantage which a well-stocked owner had over one who was not so fortunate, was a very decided factor in the final production and profits. It was therefore realized that the provision of storage facilities was one of the essentials in redesigning the mill.

The general layout of the old and new property is shown in the accompanying drawings. Many of the buildings were retained, though their installations were generally shifted and the routing system entirely revised.



WASHERS WERE MADE OF REINFORCED CONCRETE

In addition some of the buildings were torn down and replaced by more modern structures. An additional railway entrance was provided and the old wooden shipping platforms were replaced with others of concrete.

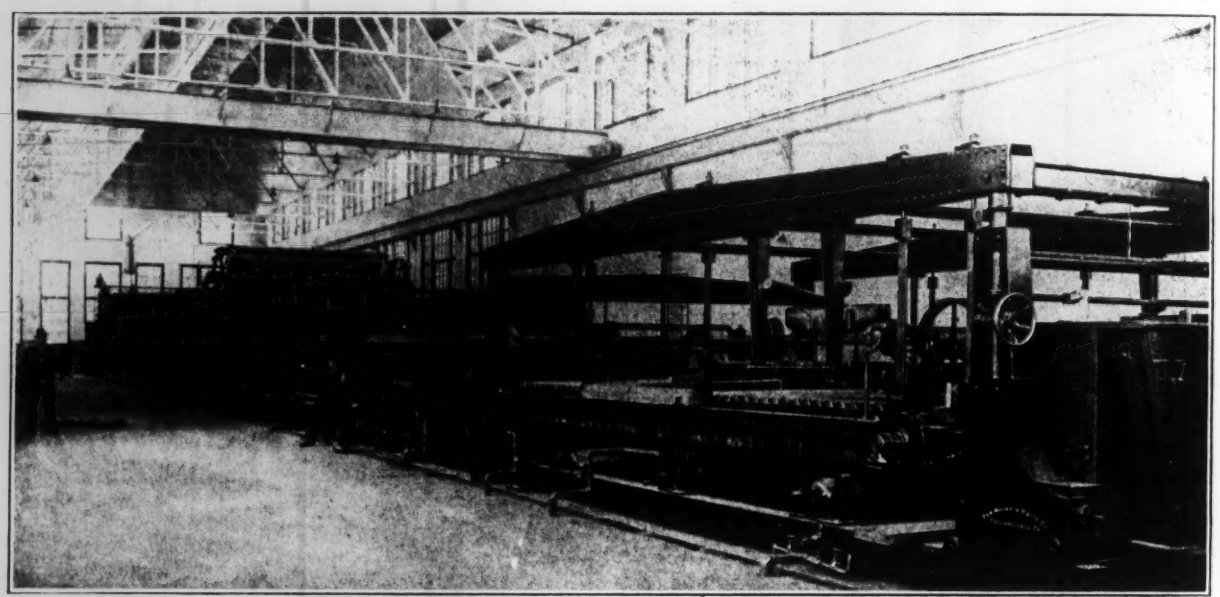
In order to make clear the nature of the new construction there will be described briefly the process of paper making in the new mill, enumerating the machines and equipment which the manufacture of book paper necessitates. The raw stock which will be used will vary from rags down to magazine stock with a proper addition of sulphite pulp and other ingredients. The book stock will be brought by means of hydraulic elevators to the sorting room, where it will be sorted, shredded, dusted and conveyed by power-operated mechanical conveyors to the floor space over the rotary bleach boilers in the northeast corner of the plant. Next it will be dumped by gravity to large reinforced-concrete chests in which the stock will be kept constantly in motion by means of agitating arms. From here it will be pumped by means of specially designed centrifugal pumps to large reinforced-concrete washer tubs, where the stock is washed thoroughly free of any foreign matter such as metal or ink. It will then again be dumped by gravity to large reinforced-concrete chests and kept in constant motion by means of agitating arms. The next step will be to pump the stock to a mezzanine floor, where it will pass through a riffler, large screens and a thickener, which last extracts the excess water from the stock. From here it will again flow by gravity to two large reinforced-concrete chests, again agitated and pumped to beating engines. From these beater tubs the stock will be dumped and will flow by gravity to concrete vats and pumped again to Jordan engines.

When the Jordaning process is finished, the stock will flow by gravity to the machine chest, a large reinforced-concrete vat in which the stock will be agitated by arms and pumped to the machine. The machine is the final stage where the paper will be formed into the sheet, rolled, dried, calendered and wound into rolls. Here the rolls will be picked up by means of an air hoist, placed on a truck on rails and rolled into the cutting room, where a full width (138 in.) duplex cutter will be situated, which will slit and cut into sheets twelve large rolls in one operation. It will then be packed and ready to ship. The heaviest and most important part of the equipment is the paper machine, which measures 230 ft. in length and weighs upward of 500 tons. This machine is undoubtedly among the largest ever built for the Eastern States and the largest in Massachusetts. It will produce a sheet of trimmed paper 138 in. in width.

The machine room building has brick walls laid in 85% cement and lime mortar, with reinforced-concrete floors resting on Bethlehem steel beams and H-columns, reinforced-concrete spread footings, skeleton columns in the walls supporting the structural floor members and steel roof trusses. The roof consists of kyanized long-leaf yellow pine roofers resting on kyanized purlins. On these roofers it was found advisable, in order to eliminate any possible condensation on the ceiling in cold weather, to place sheets of pressed cork in tar and covered with the regulation 5-ply tar and gravel roof.

To facilitate the erection as well as future handling in case of repairs of the large parts of the machine, some of which weigh upward of 12 tons, it was found

expedient to provide a 10-ton hand-operated traveling crane with two 5-ton carriages. This crane is carried on steel brackets riveted to the Bethlehem columns and spans the clear width of the room. It will be noticed that the south wall of the machine room is also the north wall of the finishing room building. This old wall was utilized, channels cut in for the insertion of the wall columns and seats provided to carry the old timber beams in the finishing building. The wall was carried 12 ft. above the finishing room roof so that large window spaces could be provided on the south side. The position of the old No. 3 machine room was such that it interfered with the natural light and ventilation. Therefore it was decided to tear down this partition wall and create a light and air well between the two buildings for the greater portion of the length of the room.



INSIDE THE MACHINE ROOM, SHOWING DRYERS SET UP

During the process of drying the paper on the drying cylinders upward of 35 tons of water will be evaporated every 24 hours. It was necessary to provide some means of carrying out this vapor without causing condensation in the room. It was decided to design a large hood directly above the dryer part so as to create a direct passage for the steam to the ventilator above, thus eliminating its spread over the entire room. This hood is constructed of heavy asbestos board resting on steel angles fastened with carriage bolts and check nuts. Instead of placing it in its accustomed position lower down right over the dryer, this hood was placed high up between the trusses so as to allow the free travel of the crane from one end of the room to the other. The ventilator is designed in its entirety of kyanized yellow pine timber, carefully flashed at the junction of the roof with lead flashing and covered on the exterior with prepared shingles. On the interior as well as the exterior it is lined with cork board to prevent condensation, sheathed with Georgia pine sheathing and nailed with copper nails to prevent rusting out from excess moisture. The roof of the ventilator is also covered with cork board and tar gravel roofing.

The machine-room floor, of reinforced concrete, was planned for a loading of 350 lb. per sq.ft. and specially designed girders strong enough to carry the different parts of the machine were provided. Owing to the rapid motion of the machine, drying cylinders and other parts, it was deemed advisable to provide a large factor of safety to offset vibration. The girders carrying the sills of the machine are made up of a pair of 20-in. H-beams and carry a 30-in. concrete cushion to deaden the effect of the vibration. Extra Bethlehem columns were placed under each calender stack, shortening up the span and minimizing the effect of the rapidly revolving rolls. These stacks weigh 57 tons each and the rolls in them will revolve at times at the rate of 200 r.p.m. The peripheral speed of the machine will vary from about 150 to 450 ft. per min. In designing the wall columns due consideration was given to the eccentric load on the brackets caused by the 10-ton crane.

The machine room was provided with every facility for handling the dry broke and the wet broke without resorting to trucking. Large openings were left in the floor directly opposite the calender stacks and the first press, so that as broke is made it will be thrown through these openings into the basement and carted to the broke beater located there. To economize space, straight stairways were abandoned and instead four cast-iron spirals were installed, located in such positions as to eliminate unnecessary steps for the machine tenders and helpers. In addition, a fireman's brass sliding pole was provided at one end of the room for rapid descent to the basement floor.

In the beater room the design and layout of the steel in the floor presented some difficult problems owing to the fact that the old main line shaft had to be preserved, and it took much juggling of layouts before a final simple and economical plan was decided upon.

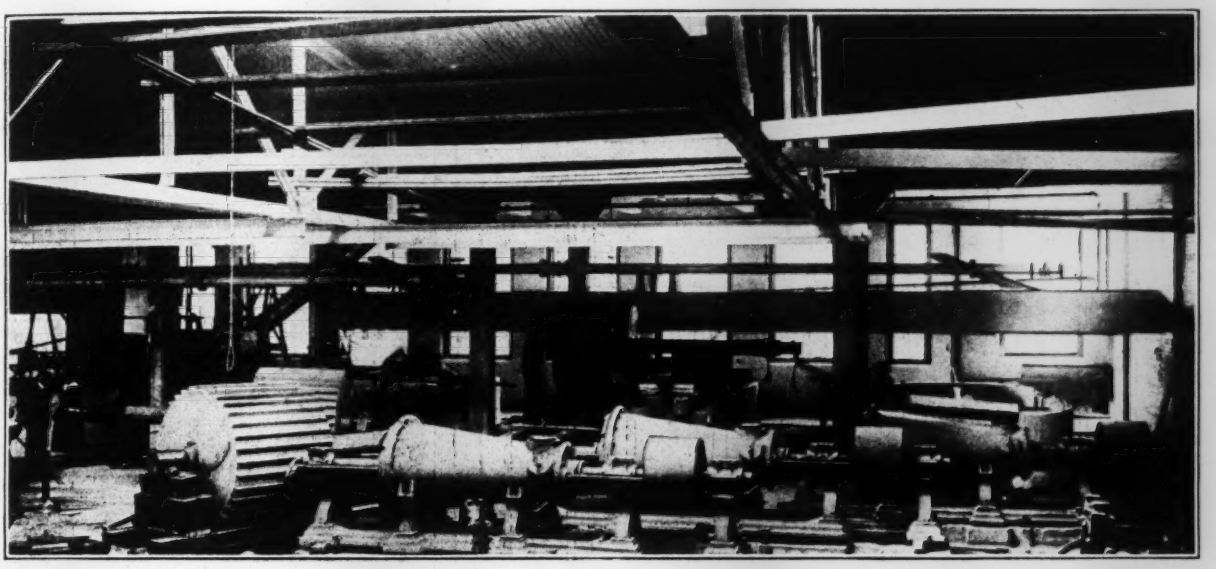
In the old layout of the beater room the roof was carried by wooden trusses supported by longitudinal girders with varying spans resting on cast-iron columns. It was decided after some investigation that it would be of great advantage to eliminate all posts in that room, so as to facilitate the trucking there. Seventy-foot span roof trusses were therefore designed, spanning across the entire width of the beater room. In the washer-room building, which was built on a vacant lot east of the beater room, it was possible to use a more regular layout.

The basement in this building was made on the same level as all the other buildings, and the first floors of all the buildings were brought to one level. The first floor was of regular design with a 16-ft. ceiling, but when closer study was required to provide room for additional equipment it was found that the headroom was not sufficient, as the lack of space made it necessary to design a mezzanine floor to carry the riffler, knocker screens and thickener. An 18-ft. floor height therefore was decided upon.

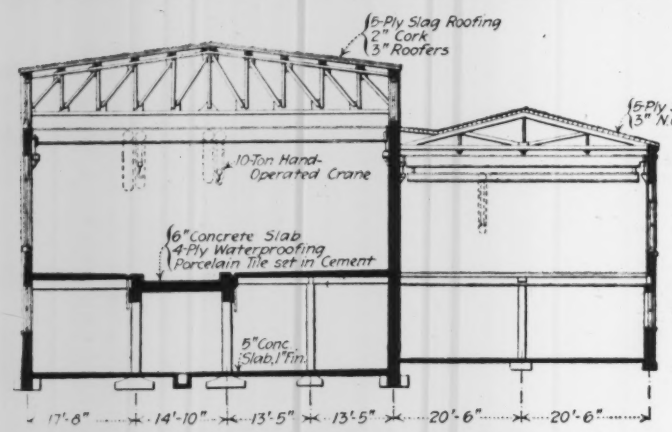
The supports for the three rotary bleach boilers were given special attention. It was found advisable to place these boilers as high as possible to provide plenty of clearance under them, and at the same time make loading easier from the floor above. A special harness was designed which is carried partly on extra girders and partly by channel hangers supported from the floor above.

The floor construction throughout this building is of standard Carnegie beams entirely encased in concrete, carrying a well reinforced concrete floor. The sorting room floor consists of a reinforced-concrete slab with yellow pine sleepers embedded in cinder concrete, carrying maple top-flooring. This was done for two reasons: first to eliminate dust; second, to provide an easy walking floor for the female employees. Trolley beams are provided throughout the mill wherever heavy loading or machinery parts are to be transferred from one section of a room to another. In the basements special U-bolts were inserted directly over all line shafts to facilitate the erection and future handling of shafting and bearings.

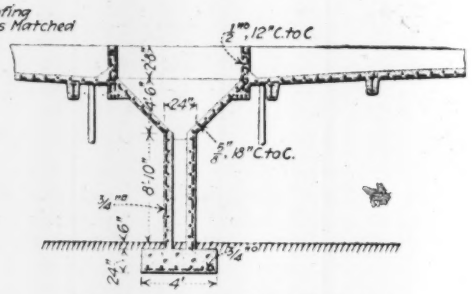
Throughout the mill, as far as it was possible to predetermine the location of pipes, conduits, etc., concrete floor inserts were located in the floor slabs for supporting them. Iron pipe ferrules were placed in the concrete slabs wherever pipes went through the floors. As a large quantity of water always is used in a paper mill and the washing up of floors with hose is general, these ferrules were placed so that they extended 2 in. above the finished floors to prevent leakage to the floors below. Concrete curbs reinforced by steel rods were built around all floor openings for the same reason. All the concrete floor slabs were given a granolithic finish and treated with floor hardener to prevent dusting. Both the Master Builders and Metalcrete floor hardeners were used in the rooms where the trucking will be heavy and especially designed cast-iron floor plates were imbedded in the floor where the trucking will predominate. To facilitate the washing up of all floors, sufficient floor drains were provided throughout. In the machine room large gutters were provided on each side of the machine running the full length of the room and these at intervals have downtakes leading to the basement. In the machine-room basement it was found advisable to build a large U-drain in the center of the room running the full length of the building, which takes all the machine water, wash-up water and chest sewage and empties into a 24-in. tile drain, which in turn empties into the river. In the beater-room basement, due to the width of the building, several U-drains were provided running the full length of the building. This also takes the drainage, wash-up water and waste water from all the machines. It will be noted from the several sketches shown here that a great many large reinforced-concrete chests are prominent. Some of these chests are tile lined, while others are only surfaced on the interior. All the chests are substantially reinforced for expansion and contraction as well as water pressure.



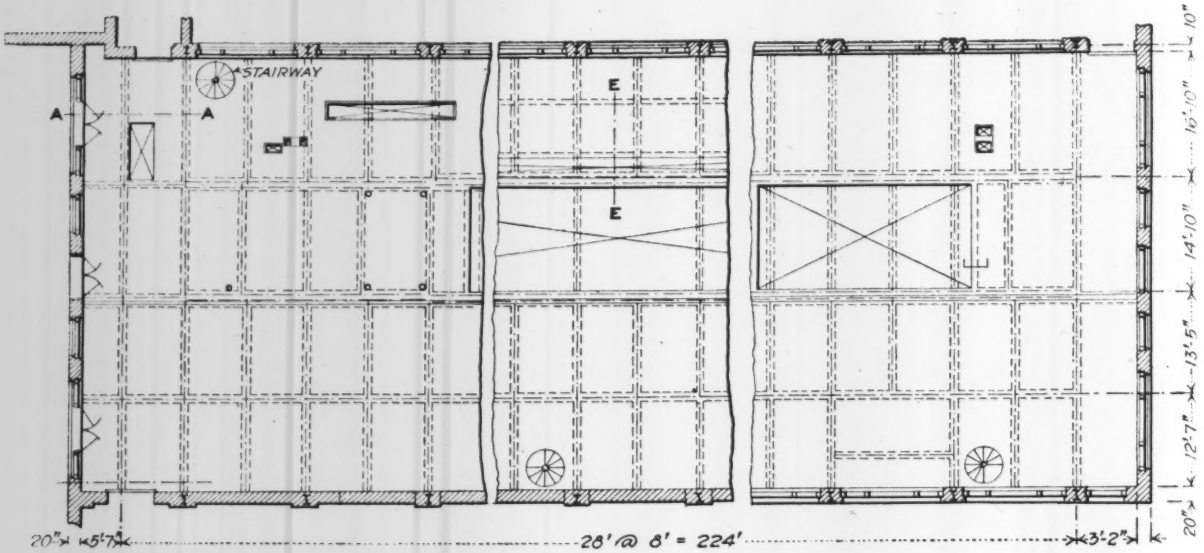
BEATER HOUSE BEING BUILT. CONCRETE WASHERS IN BACKGROUND AND JORDAN MACHINES IN FRONT

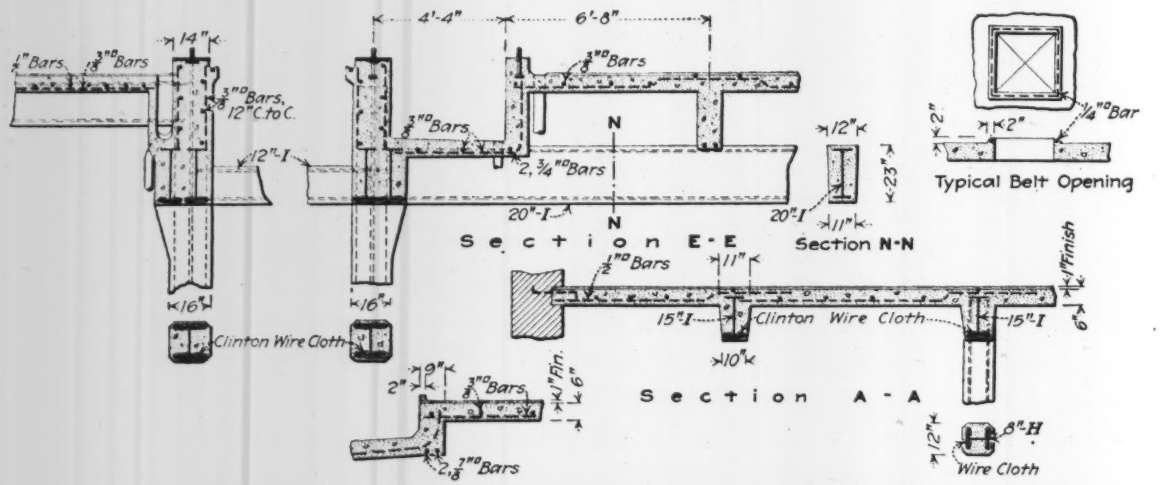


Section through Machine and Finishing Buildings



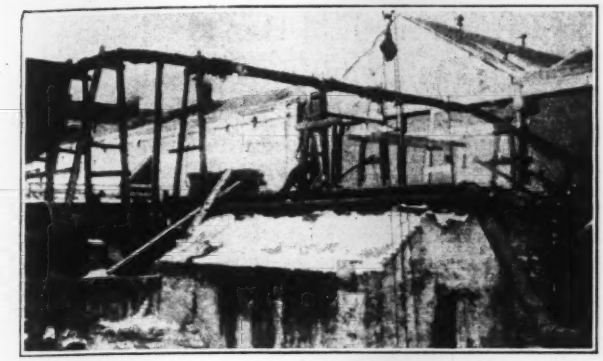
Section through Save-all Drain in Machine Shop





NEW MACHINE BUILDING IS OF STEEL FRAME WITH CONCRETE FLOORS

The sanitation of the mill and the comfort of the employees were well kept in mind. Well arranged, light, airy and comfortable rest rooms were provided for the female employees, with communicating lavatories. For the men well-lighted, tiled toilet rooms and showers were built, with sanitary, up-to-date equipment. All the walls in the toilet rooms are white tiled, with terrazzo floors and vitralite partitions. Wherever it was possible wash



PRESSURE STEAM MAIN SUSPENDED DURING RECONSTRUCTION AND WATER PIPES KEPT GOING ACROSS DEMOLISHED BUILDINGS

rooms and toilet rooms were kept separate. The entire mill is provided with automatic sprinklers in accordance with the best methods and regulations of the National Board of Fire Underwriters. Bubbling drinking fountains, fed by city water, refiltered, will be installed and distributed over the entire mill, with individual ice chests.

The lighting of the entire mill was given special attention. Economy of the layout as well as utility and economy of future lighting was taken into consideration. In general large units were used, provided with shades of different shapes to give proper distribution. All wires are run in sherardized conduits, provided with waterproofed sockets and special holders. The circuits are arranged so that either concentrated or interval lighting can be used. Only modern fittings were used.

Although construction was begun Nov. 1, 1916, the old mill did not cease production until June, 1917. During the entire seven months, while the large machine-room building and finishing-room building were being constructed and the old buildings were being torn down, every possible effort was exerted to do the construction work in such manner as not to interfere with the operation of the mill. The old rag rooms were torn out first, shutting off the old machine rooms and beater rooms so that no dirt nor dust would enter into the product. The entire beater-room floor, which was in a state of dilapidation, was shored up from the basement while the removal of the old drainers located in the basement was in progress. Many water lines and high-pressure steam lines had to be temporarily supported while the excavation and demolition were in progress. The difficulty of operation was increased by the severity of the winter.

In laying out the column footings, specially designed wooden template frames were used for the column bolts and set with a transit to the proper line and grade. This was done for the reason that it was essential to keep the outside column lines in a perfectly straight line so that the upper tier of columns would come right for receiving the crane. Cutting the channels in the north wall of the finishing room building for the insertion of the steel columns of the machine room building was accomplished by cutting alternate channels to eliminate any possibility of local settlement or development of cracks in the old wall. These columns rested on new reinforced-concrete footings and were plumbed and bricked up as fast as they were set. It was gratifying to find how well the steel beams and girders fitted when a little extra precaution was taken in lining up every row of columns. Before the footings were concreted diagonal checks were taken on all the column footings to exclude any possibility of error.

Actual construction of the machine room began in February and by the end of May the entire machine room building was 95% complete, with the exception of the basement concrete floor. When the owners finally decided to shut down the mill in June, a night force was organized and work was kept up for 24 hours a day, to hurry the demolition of the old beater building and the removal of the machinery, some of which had to be preserved for other divisions while other parts were to be used in the new layout. When the demolition was completed the night work was abandoned and work during the day was rushed with every possible speed, because a date was set for the completion of the entire mill. Here also templates were used to set the column bolts and diagonal checks were made on these before concreting. In erecting the steel both hand derricks and power derricks were used. The steel throughout the mill was riveted with air guns and the rivets tested after driving. A gasoline driven saw was used for cutting forms, with the exception of a few instances, and good progress was made in that way with the forms. The forms were all hung from the steel beams and special clamps used on the column forms. The forms from the machine room floor were used over again in the beater room floor wherever possible, thus lowering their cost. Finally some of these forms were used for intermediate lining for the stock room floors, which are of timber construction. All circular forms for the chests and tanks were made in the shop and brought to the job ready for erection. In constructing the four reinforced-concrete washer tubs, which are 28 ft. in length, 3½ to 4 ft. high and 9 ft. in width, the forms were built of circular ribs lined with 22 gage sheet iron, to produce a smooth surface. They were used three times before final abandonment and are now still in perfect condition.

The concrete on the entire job was mixed by ½-yd. steam operated mixer, which has proved to be very serviceable and rapid in operation, as high as 650 bags being mixed in one 9-hr. day, using a 1:2:4 mix. Concrete buggies were used on the greatest portion of the work, but it was found that where concrete was to be placed in narrow spaces the wheelbarrow was much more efficient and gave a better finished surface. The bricks which were removed from the old mill were cleaned and used again in the interior of the new walls. Some of the old timber which was removed from the old mill was used for shoring, bins and runways. The policy on the construction was to conserve any portion of the mill removed, thus considerably lessening the cost.

The construction plant was so laid out that the handling of material was reduced to a minimum. The trap rock storage bin was built adjacent to the railroad tracks so that only one handling was necessary. Cement storage sheds were also built adjacent to the railroad, and cement bags were shot in from the cars through a side opening. The sand came from a local sand bank and was screened there before delivery by automobile

trucks and carts. The mill machine shop gave great aid in the repairing of tools and other work.

The designing of the mill and the layout began simultaneously with the demolition and excavation, drawings were rapidly turned out, steel details prepared and the steel put on its way in due time, so that no time was lost in waiting for material. All drafting was done at the mill site, a separate office having been provided for the engineering force, which consisted at first of the writer and a draftsman but was eventually augmented by two additional men. All the material was ordered through the main office of the construction company, which helped matters greatly by following orders up and facilitating the delivery of material. All material as delivered was checked and permanent records made to help the checking of the invoices. A tickler system was installed for the tracing of overdue material.

The entire design of the buildings as well as the mechanical layout and mechanical details was done by the Casper Ranger Construction Co. of Holyoke, Mass., who are the general contractors acting as engineers and contractors. The work was greatly facilitated by the considerate help and encouragement given by John W. Brassington, chief engineer of the American Writing Paper Co. Many important details which make for the successful operation of a paper mill were worked out with the hearty coöperation of Martin V. Brooks, superintendent of the mill for a number of years, who kept in constant touch with the design and construction from the beginning. The work was inspected in part by the company's field engineer, C. S. Hale, and the chief steam engineer, L. E. Small. The entire design and construction were done by and under the direct supervision of the writer, the construction work being handled by the construction superintendent, James J. Wall. Joseph Ranger, secretary of the Casper Ranger Construction Co., gave the job his special attention, devoting much time to it. The entire work was handled on a percentage basis.

Thirty-Four Commission-Plan Cities in Pennsylvania

By the addition of Bethlehem, Butler and Duquesne to the list of third-class cities in Pennsylvania on Jan. 1, the number of commission-plan cites in that state became 34. Lancaster alone, which has a special charter and a bicameral council, does not come under the state legislation of 1913, which provided that all other existing and all future third-class cities should be governed by commissions.

River Terminal Has Machinery for Handling Freight

Pile Wharf at Alton, Illinois, Served by a Number of Railroads, Is Equipped with Conveyors and Derrick

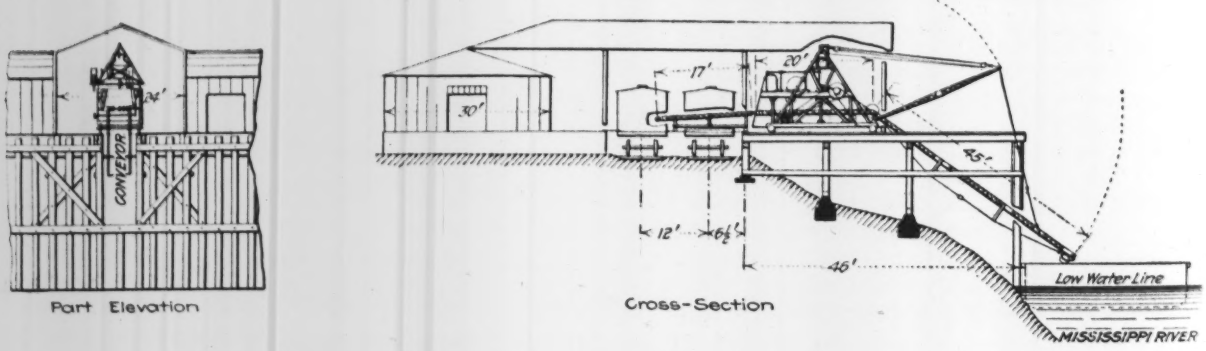
ONE of the latest developments to facilitate water transportation of freight is a riverfront terminal on the Mississippi River at Alton, Ill., built by the Illinois Terminal R.R. This company operates a belt line serving large industries, and furnishes yard and terminal facilities for about a dozen trunk railways.

Land for the new terminal was formed by the reclaiming of part of the riverfront which was valueless on account of being subject to overflow during about three months of each year. The required area was filled with sand pumped in from the river to an elevation above high-water mark. About 450,000 cu.yd. of sand was deposited, making a fill with an average depth of 18 ft. In conjunction with the filling the dredges cut a 40-ft. channel for vessels along the waterfront of the terminal.

The dock construction consists of a pile and timber wharf 330 ft. long. At the low-water line is driven a row of round piles spaced 3 ft. on centers and having waling timbers on the outside. Every third pile is attached to an anchor pile 20 ft. in the rear by a tie-rod which passes through the waling timber and both piles. The tie-rods are adjusted by means of turnbuckles. Pile clusters at the upstream end provide for the mooring of boats. Near the middle of this wharf, supported on piles and posts, is a platform which extends back to a pair of stub tracks and carries a freight-handling conveyor. Beyond the tracks there will be a warehouse 30 x 250 ft. The tracks are about 600 ft. long, and are connected with the main part of the railway terminal, which is some 1200 ft. back from the dock wall.

About 2½ miles of track have been laid, and there is ample room for additional tracks and facilities when the volume of traffic warrants their construction. Ground is available also for industrial enterprises. Electric power from the Keokuk hydro-electric plant is furnished by a transmission line which crosses the property.

Handling of package freight is provided for by a Brown portable conveyor designed especially for the work. As shown by the drawing, it consists of a trav-



RIVER-FRONT DOCK HAS FREIGHT-HANDLING CONVEYOR

eling carriage with three chain conveyors. The first section is mounted on a 45-ft. frame pivoted to the carriage and suspended from a boom, so that its outer end can be raised and lowered to suit the deck elevation of boats and barges. In the rear of this is a horizontal section 20 ft. long, extending through the carriage. The third is an adjustable section 17 ft. long which handles freight into and out of railway cars. This machine is operated by a 10-hp. electric motor. Its conveyors run at 80 ft. per minute and can handle packages up to 400 lb. in weight. A 5-ton stiffleg derrick with a 90-ft. boom will be mounted on the dock to handle bulk freight between the cars and the vessels and to handle packages which are too heavy for the conveyor.

The piledriving was done by E. B. Seitz, Alton. The contractors for the grading and filling were the Kinser Construction Co., St. Louis, and P. C. Hart, Duluth, Minn. All other work was done by the railway company's forces under the direction of H. H. Ferguson, vice-president and general manager, and H. H. Rogers, engineer maintenance of way, Illinois Terminal R.R. The terminal is expected to be ready for operation this month.

Splice Bar Causes Railway Accident

BREAKING of two adjoining rails and the connecting joint derailed a fast passenger train some time ago near Cleves, Ohio, on the Cleveland, Cincinnati, Chicago & St. Louis Ry. The cause of the accident was not obvious, as the two rails were found broken into a large number of pieces and the entire problem of rail defects was therefore involved. Full investigation by the Interstate Commerce Commission, reported on in a bulletin just issued, absolves the rails from responsibility and lays the blame on the splice bars.

It is determined that one of the two splice bars at the rail joint in question had cracked all the way through prior to the accident, and that the opposite splice bar broke without previous cracking, under the train which was derailed. Examination of other rail joints showed that many splice bars have small cracks, at bolt holes or at the notches formed in the bars for the track spikes. A few splice bars were found cracked through. The study of railway accidents during recent years has not given much attention to splice bars, and the present report is of special interest on this account.

Another feature of the investigation and report is the study of the effect of wheel burns on the tread of the rail. The track in the neighborhood of the accident showed the surface of the rail extensively roughened and burned in many places by slipping wheels. The local surface cracking produced by this burning was found to penetrate only a minute distance into the rail, and the surface material which had been hardened by the action formed only a thin layer, below which was normal metal.

Residual stresses in the rails involved in the accident were measured in the course of the investigation, though they did not affect the accident. Compressions of 20,000 and 31,500 lb. per sq.in. were found. These were extreme values, but values of 16,000 to 17,000 lb. were found in a number of places.

Health Board Orders Water Company to Install Filters

CALIFORNIA has a comparatively drastic public health law relating to the purveying of undesirable water. It was amended by the last session of the legislature. Acting under this law, the State Board of Health has ordered the West San Joaquin Valley Water Co., of Los Banos, to install a modern rapid filter plant, together with reaërating facilities, by July 1, 1919. Approved plans are to be prepared by Sept. 1, 1918. The act requires all purveyors of water to 200 or more consumers to hold a permit from the health board; the holding of a hearing before an examiner appointed by the State Board of Health on receipt of application for such a permit; the granting of a revocable permit in case the supply is found to be pure and wholesome; the denial of a permit in case the supply is not pure, clean and wholesome, together with the ordering of such improvements or improved operation as is necessary to secure a pure, wholesome water, and the granting of a temporary permit for a period to be specified to permit compliance with these orders. The act provides for the issuance of an injunction against supplying water without a permit, and fine and imprisonment for violation of any of the orders of the State Board of Health based on the act. The fine is not to exceed $1000 per day; imprisonment is not to exceed one year for each day's violation. The State Board of Health is empowered to appoint a competent person, who shall be paid by the petitioner, to operate the plant.

Some of the more important findings in the case of the Los Banos supply are: That the water-supply, derived from the watersheds of the San Joaquin and Kings Rivers, is conveyed in open canals, passing through pasture and other fields for about 37½ miles; hence is subject at all times to excessive sediment and turbidity; that the treatment, which now consists of filtering through rock-filled sumps, and chlorination, is inadequate; that the water is at practically all times excessively contaminated with intestinal organisms and is so repellant that consumers will not drink the water in sufficient amount to maintain a proper standard of health; that many consumers use household filters to render the water clear enough for drinking and cooking purposes; that the water is so turbid at times as to be unfit for laundry uses and repellant for bathing purposes; that many consumers have resorted to wells polluted and highly mineralized in preference to using this supply. A large number of consumers submitted a signed statement that they desired a clean, clear and potable water and would pay increased rates for such a water in case the state railroad commission should find that the company was not receiving an adequate return.

Oregon Purchases a Paving Plant

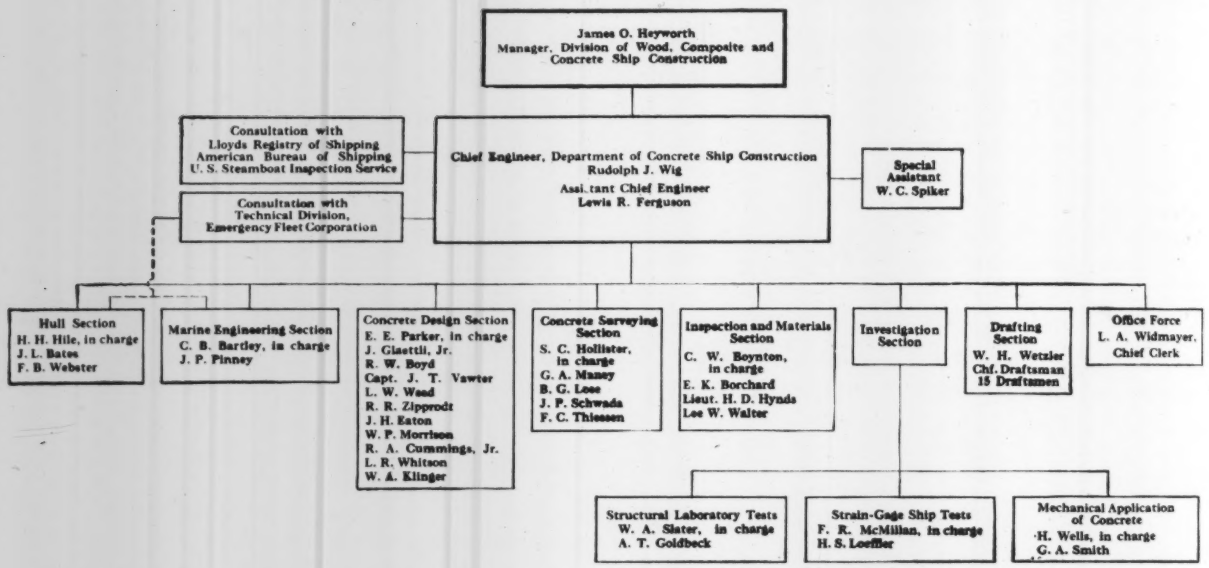
The paving plant owned by the Oregon Independent Paving Co., Portland, Ore., was recently purchased from the company by the State Highway Commission of Oregon for a price said to be $13,500. When in possession of this plant the commission intends to handle much of its own paving and maintenance work during the season of 1918. If it will consider itself a competitor of road contractors has not yet been made public.

Government Concrete Ships Engage Large Organization

Number of Civil Engineers in Branch of Shipping Board Working on Novel Problems of New Marine Type

THE United States Government has undertaken in earnest the construction of concrete ships. As stated in *Engineering News-Record* of Feb. 7, p. 277, the United States Shipping Board about the first of the year organized a concrete ship division to make a special study of the novel problems presented by the use of this new material for marine construction, and this division very soon accepted three separate proposals for the construction of concrete ships, which proposals were translated by the Shipping Board into contracts.

ORGANIZATION CHART, DEPARTMENT OF CONCRETE SHIP CONSTRUCTION



SHIPPING BOARD BRINGS TOGETHER MANY CIVIL ENGINEERS TO DESIGN AND BUILD ITS CONCRETE SHIPS

In addition, the division started on the design of a ship of its own, prepared to review all independent designs submitted to it and began to form an organization which would be able to handle the whole design and construction of such ships of this type as the Government should build. This organization is now about perfected; its details are the subject of this article.

The organization chart as it stands at present is shown herewith. This chart may be changed in some minor details, and the personnel is constantly being added to. After construction starts a number of field men will be required. But the chart as it stands represents an entirely new organization brought together in two months from all sections of the United States to work on problems which in their separate parts are familiar to many engineers, but which in the aggregate represents a radical novelty in engineering practice.

The whole work of the division is under the general direction of James O. Heyworth, the Chicago contractor who came to the Shipping Board to take charge of the wooden-ship construction, but who has since taken over all construction outside of steel. In direct supervision of the concrete ships as chief engineer is Rudolph J. Wig, of the Bureau of Standards, who has conducted the Government's investigations into the concrete ship since our entry into the war, and assisting Mr. Wig, as assistant chief engineer, is Lewis R. Ferguson, who was also connected with the early studies on the new type of boat. W. C. Spiker, a concrete and bridge engineer of Atlanta, Ga., is associated with the chief engineer's office as special assistant. Under the chief engineer are eight divisions as noted on the chart, each with a separate function and each independent of the other.

The hull section is made up of naval architects whose duties it is to analyze the stability, bending moments and shear of the ship's hulls, both those designed in the office and those submitted for approval. So far all of the hull types are replicas of certain other types common to steel and wooden vessels, and no hull peculiar to a concrete ship has been developed. The marine engineering section is concerned with the mechanical equipment of the ships. Inasmuch as the ships so far considered have been designed to use, as far as possible, the engines and fittings of the Shipping Board's standard wooden ship, this division's duties have been merely to revise these standards in such minor particulars as are found to be necessary. Both these divisions, which it will be seen are in a field outside of civil engineering, are in close touch both with the Technical Division of the Emergency Fleet Corporation and with the three shipping bureaus, Lloyd's Bureau of Shipping, the American Bureau of Shipping and the United States Steamboat Inspection Service.

Four sections are concerned with the structural qualities of the ship. The concrete design section, which is headed by E. E. Parker, lately city engineer of Madison, Wis., has entire charge of the structural design of the Shipping Board's own concrete ship. The

hull type having been selected, it is this section's duty to analyze the stresses and provide the proper members to meet these stresses—in short, the usual procedure in other structures. Similar work is performed on outside designs by the concrete surveying section, of which S. C. Hollister, of the Corrugated Bar Co., Buffalo, is the head. Not only does this section review the designs of all the ships submitted by those to whom contracts are let—and such designs must be approved by the Shipping Board before the ship can be built—but it will undertake to review any design submitted to it in good faith. An inspection and materials section under C. W. Boynton, for many years inspecting engineer of the Universal Portland Cement Co., is in charge of all construction. It will investigate the materials to go into the ships to be built and will keep a close watch on the construction itself, through resident engineers at each yard.

An investigations section is divided into three independent units. One devoted to structural laboratory tests is headed by W. A. Slater of the University of Illinois Experiment Station. Experiments have already progressed favorably on large shear pieces designed to resemble ships' parts, and investigations are under way on reversal of stress simulating the reversal to be expected in a ship at sea, and on the value of bond in coated reinforcement, for as a protection against possible corrosion by sea water some effective covering will be provided for the steel. Under Prof. F. R. McMillan, of the University of Minnesota, an investigation of the strains in concrete ships in the water are to be made. So far as is known this is pioneer work for any kind of ship. Strain gages are being prepared with which to measure deformations in variously selected parts of the completed hull after it is launched and thereby to figure out the stresses to which the members are subjected. Ship hull design is very largely empirical. By these measurements it is hoped to arrive at some more rational bases of design.

A third branch of the investigations corps is studying the various mechanical applications of concrete, such as with the cement gun and the concrete atomizer. The increased density of concrete so placed is very desirable, but the practical placing in fairly large sections presents a number of difficulties which are being investigated. H. Wells, of the Trussed Concrete Steel Co., is in charge.

All of the drafting work is taken care of by a force of fifteen men under the direction of W. H. Wetzler, who was chief designer for Mr. Heyworth in his Chicago contracting firm.

Brief mention of the latest connection of some of the engineers whose names appear on the chart will indicate the type of men who have been brought together on this new work. J. Glaettli was instructor in structural engineering and mechanics at the University of Wisconsin; R. W. Boyd is a New York consulting engineer; Capt. J. T. Vawter is a Los Angeles concrete engineer now in the Engineer Reserve Corps and detailed to this work; L. W. Weed was with the Turner Construction Co., concrete contractors of New York; R. R. Zipprodt is from the staff of the University of Illinois; J. H. Eaton is from the supervising architect's office, and W. P. Morrison from the Witherow Steel Co., Pittsburgh. In the concrete surveying section Mr. Maney is from the Forest Products Laboratory at the University of Wisconsin, Mr. Lose from the Carnegie Institute at Pittsburgh, Mr. Schwada and Mr. Tiessen from the University of Wisconsin.

In the inspection section Mr. Walter has had charge of a large amount of concrete construction for the Erie R.R., Mr. Borchard is an Atlas Portland Cement Co. man and Lieutenant Hynds, recently with the Turner Construction Co., is an officer of the Signal Reserve Corps detailed to the concrete ship work. Mr. Goldbeck is well known for his investigation work in the Office of Public Roads and Rural Engineering. Mr. Loeffler is from the bridge department of the Great Northern Ry. and Mr. Smith is from the Bureau of Standards.

This force is now in good working order and it is hoped to have the first 3500-ton concrete ship in the water by the middle of May. Already work has started on the ship of the Liberty Shipbuilding Co., which has leased an old shipyard at Brunswick, Ga., a yard which was equipped with ways and handling devices sufficient to build the concrete ship. The Shipping Board's own design is about 75% complete and should be ready by the middle of March. A contract is practically completed with the San Francisco Shipbuilding Co. for a concrete ship of 7500-ton dead-weight carrying capacity to be built in the yard where the 4500-ton San Francisco ship—a private enterprise, but one carefully watched by the Government—will be launched Mar. 14 if all goes well.

By the middle of the summer it is expected that the country will know beyond the possibility of theoretical criticism the value of the concrete ship as a partial savior in the present crisis.

City Cannot Pay for New Interstate Bridge

The Main St. bridge across the Wabash River in Vincennes, Ind., connects main highways in Illinois and Indiana and is on the principal road route between Cincinnati and St. Louis. Now fifty years old, the bridge is in such condition that while carrying a heavy traffic it is considered unsafe and a new bridge is needed. J. S. Spiker, consulting engineer, Vincennes, in a paper read recently before the Indiana Engineering Society, described the old bridge as "one of Vincennes' chief liabilities." As the city it not able financially to construct a new bridge, an important road, he said, is apt to be interrupted soon unless means are found for state or national aid in building the bridge.

The old structure was built by a toll company, the city taking half or more of the stock. It was completed in 1868. In 1889 the city bought the outstanding stock and abolished the tolls. The four fixed spans and draw span were wooden Howe-truss structures, the draw span having the bowstring shape. Two of the fixed spans are practically in their original condition, while in the draw span a number of the diagonals have been replaced repeatedly. The two easterly fixed spans were replaced in 1875 by iron bowstring trusses.

The original cost of the bridge was $45,000; its total length is 782 ft. Temporary repair of the two east spans after a cyclone in 1869 cost $15,000, and the subsequent replacement by iron spans cost $10,000.

Thinks Federation of Strong Local Societies Needed for Engineering Unity

Organization Like That of National Chamber of Commerce Advocated by C. E. Drayer—Says Engineering Council Has Thus Far Failed—Places Hope in Committee on Coöperation or American Association of Engineers

THAT the Engineering Council has in a year in no wise justified its existence by deeds was charged by C. E. Drayer last month in an address delivered at the annual meeting of the Minnesota Joint Engineering Board at Duluth. Engineering unity was his subject; and the burden of his argument was that real unity would come only through a federation of strong local autonomous organizations, similar to the federation of commercial organizations forming the Chamber of Commerce of the United States. For the leadership of this federation Mr. Drayer picked the Committee on Coöperation or the American Association of Engineers. His address is here presented substantially in full.

Chamber of Commerce Organization

During the last few years a federation of commercial organizations of the United States has been formed under the name of the Chamber of commerce of the United States of America. There are now enrolled some 600 commercial organizations besides a considerable number of individuals. Its purposes may be briefly stated: To study the work of existing progressive organizations and in the light of experience to spread this information to all commercial organizations desiring to increase their efficiency; to advocate standardization of association methods and effort and to urge the adoption of those standards which have been found most effective; to act on the assumption that the National Government desires to work in harmony with the commercial interests of the country and will accept their coöperation in an endeavor to make all business legislation constructive.

Time will not permit a fuller description of the United States Chamber of Commerce, but that it has done a great amount of effective work is apparent to anyone who makes any claim to be informed. Its strength is due to the fact that its roots are in the soil. It stimulates, fosters, and develops the *local* commercial organization from which it draws its power to be a force in the nation. When a referendum is taken on a national question—there have been perhaps a dozen referenda—the legislators at Washington know that the result is the united opinion of many thousands of business men, and they give heed accordingly.

I say to you emphatically that the engineering profession will not come into its own until we have strong local autonomous organizations such as will be found—they haven't yet arrived, but they will—in Duluth, St. Paul, Cleveland, Detroit, Pittsburgh, Buffalo and other places. No one has yet discovered the organization that will be continuously effective until all the way through, down to the individual, there is in the minds of everyone a recognition of individual responsibility and a realization that each is the creator of results.

Another point to keep clearly in mind is that the local chambers of commerce are highly competitive each with the other, yet this does not keep them from the larger vision of the fruits of coöperation outlined above.

There is another organization whose objects and structural principles the engineer may examine with profit—the American Institute of Architects. When we realize that its total national membership is not much over 1000, less than the number of members in any of a half dozen local engineering societies, we may rightly wonder how it accomplishes so much. Is the architect in any way superior as an individual to the engineer? If not as an individual, then there must be a superiority in combination, for no one is so bold as to say that any one organization of engineers has left a stronger imprint of its personality on the nation than the American Institute of Architects.

Article II of its constitution sets forth the objects of the organization: "To organize and unite in fellowship the architects of the United States of America and to combine their efforts." This very fundamental and cardinal organization principle threads through all its parts. The institute is made up of chapters "which shall be incorporated under the laws of the state wherein they are located." "The government of the institute shall be by delegates from the chapters in convention assembled, its officers and board of directors." "No person shall be eligible to membership in the institute unless he be at the time a member of a chapter, providing a chapter exists in the territory in which he resides." Each chapter is entitled to two delegates at the convention plus one for every 10 institute members. Here are fellowship and democracy, and like the United States Chamber of Commerce, the institute is rooted in the soil.

Engineering Progress Toward Unity

The American Society of Civil Engineers is the oldest engineering organization in this country and was founded in 1852. Its early life was a struggle, and it was not until 1869—17 years after its organization—that its first annual meeting was held. Its membership was then 160. Significant of its early pharisaical policy, now happily tending to change, is the comment of its secretary in an account written about 1904, "It has never had subsidiary branches or been affiliated with other organizations."

The American Society of Mechanical Engineers was organized in 1880. This date and the attitude of the new society are both of interest. Not only did the engineer begin to take a more progressive outlook on life, but the engineers in a few communities began to collect in groups and the beginning of the local society was made. After a decade or more, the national

societies began to see the need of responding to the demand for local activity, and the local sections were formed. Local sections, except in a very few of the largest centers, are groping in the dark. One of the first clear recognitions of the importance of the local society was in the annual address of Hunter McDonald, president of the American Society of Civil Engineers, in 1914. Now no one gainsays the importance of the local society and that it is the foundation on which we must build.

Soon we began to discover that there were problems, very human in character, which required for their solution of coördination of engineers everywhere. The demand for a new order gave rise to separate efforts, almost simultaneously born, to meet it. There were three in the national field, the Engineering Council, the American Association of Engineers and the Committee on Coöperation.

Several state federations sprang up at the same time; in the South the Georgia Federation of Techincal Societies, in the North the Minnesota Joint Engineering Board, and very recently the Association of Ohio Technical Societies. Only a few weeks old is the movement in Illinois to coördinate all societies in that state, still more recent the proposal from the president of the Iowa Engineering Society that these several state associations or societies be federated nationally. The Michigan Engineering Society is committed to a program to further legislation to register or license engineers and invites an exchange of opnion, perhaps to the end that the excellence of uniformity in the several states may be attained.

Where do these paths lead? Let us frankly consider all the factors involved and see if a conclusion may be reached.

There are four entities in the problem of unity, (1) the individual, (2) the local society, (3) state relationship, (4) national relationship. We have proceeded so far as to agree that the material and technical needs of the individual shall be met and he shall be developed into an efficient citizen. Also, the local society shall be all-inclusive and fully autonomous.

Committee on Coöperation

How are the agencies, the Council, the American Association of Engineers and Committee of Coöperation, equipped to bring about national unity? Perhaps considerations should be in the inverse order as above stated. The Committee on Coöperation was planned to be a forum for the full discussion of just such questions as the one just stated, where anyone who has a worthy idea may give it voice.

The Committee on Coöperation did not set out to establish a new society, but to coördinate the forces that are already in the field. It is a forum located in a city most accessible to the engineers of the country for the interchange of that scarcest of commodities, ideas; to deliberate and to spread abroad its findings, which have thus far been absolutely free from the dominion of any clique or special privilege.

There have appeared from time to time magazines devoted to reform and progress. Measured by the standards of unimpaired money investment and dollar dividends, they have not been successful, but if the dividends be calculated in forward steps of progress, the returns have been rich indeed. So let the engineering profession fix in its mind the desirability of a permanent congress of all societies, a forum for the free expression of thought, and it will not lose its idealism, which is absolutely necessary if we are to maintain the leadership which we have sought and which is now being thrust upon us somewhat in advance of our being thoroughly prepared.

Engineering Council

At the last conference on Coöperation, held in Chicago, among the resolutions adopted was one "requesting and urging on the national engineering societies in designating the Engineering Council to give consideration to and create, as soon as proper deliberation may permit, the machinery necessary to provide for a general permanent body made up of representatives of the various national, state and local engineering organizations of the country, in the interest of the common welfare and advancement of the profession as a whole." The commission is assuredly clear enough and broad enough.

"Each founder society shall have five representatives upon the Engineering Council and such representatives shall be designated by the governing body of such society.

"The United Engineering Society shall have four representatives on the Engineering Council who shall be chosen by its board of trustees; such representatives to be men not already designated by a founder society.

"The Council *may speak authoritatively for all member societies on all public questions of a common interest or concern to engineers* [italics ours], unless objection be made by a majority of the representatives present of one of the founder societies, or by one-fourth of the representatives present and voting . . .

"The trustees of the United Engineering Society may elect to membership in the Engineering Council other national engineering or technical societies, under such rules as the council prescribes, provided their nomination and said rules have the unanimous approval of the governing bodies of the four founder societies."

So it would appear that there must be some revision of the council organization before it can be made virile. The council has been organized about a year and has in no wise justified its existence by deeds.

American Association of Engineers

The third newcomer in the national field is the American Association of Engineers, organized in the spring of 1915. It is a militant society whose slogan is, "To raise the standards of ethics of the engineering profession and to promote the economic and social welfare of engineers." Two things are decidedly in its favor, a favorable geographical location for headquarters and the devotion to a need that has been widely recognized—the business side of the engineer's life. At the two conferences of the Committee on Coöperation held in Chicago, its representatives espoused all that the conference stood for.

Lately it has set out on a campaign to establish local chapters in principal centers, in competition with local societies where they exist. Better judgment would have counseled an effort to work out a harmonious arrangement with existing local societies. The American Asso-

ciation of Engineers was started by enthusiastic and high-minded young men. Being young and without much experience they committed the mistakes of youth. Now there are on its board of directors some of the leading engineers of Chicago. It labors under the suspicion of being a glorified labor union. Some of its publicity has been ill advised and crude and has tended to spread this cloud. However, it has lately become conscious of its shortcomings and is endeavoring to correct them. It has enough members in Cleveland to establish a chapter, and there is an endeavor to find what the Cleveland Engineering Society and the American Association of Engineers have in common, what they can do better together than separately. Thus the local society can furnish a home to the members of the American Association of Engineers, not as affiliates, because affiliation is weak, but as members of our society. Every engineer in the community should find a home under one roof, and every shoulder should help to turn the wheel and push in the same direction.

As between the two societies, employment should be under the direction of the national society. The employment problem is being handled very well by the American Association of Engineers, and the good work should be encouraged.

This analysis of the tendencies toward national unity merely indicates that the path ahead is veiled in haze and mist, but it is the usual mist that envelops the road of the morning's endeavor, and should not discourage. We have many chores to do about the home before setting out, and can wait a little until the mist clears up. If there be jealousies, let them be put aside. Let us get acquainted with each other: we are brothers because we are engineers.

Two Schools of Thought

At the present time there are two schools of thought trying to solve the problem of engineering unity. The one says there shall be one national society, all inclusive, organized somewhat as the American Institute of Architects. The other says to affiliate the locals of a state (having a local wherever there are six to a dozen engineers who can frequently get together) into a state association and the states into a national organization, following our political organization. The idea of one national, all-inclusive society implies the breaking down of existing organization structures and building anew. The other idea is to take what we have and modify only as much as is necessary properly to join or gear together. It will lead finally to a division of work according to functional ability. Thus the national societies, such as the founder societies, will continue to care for what they have done so well in the past, the technical. Let the specialties of the American Association of Engineers be employment, national publicity and direction of legislation. Civic affairs and politics must be left largely to the local and state associations for the simple reason that they are best fitted to give them attention.

But we haven't said how all these forces are to be correlated nationally. Frankly, I don't believe anybody knows. But this surely—the rank and file of the profession will not be content with the Engineering Council stalemating much longer, and will set up a new leader. That new head will be either the Committee on Coöperation or the American Association of Engineers in a new center, Chicago.

In the meantime let us in these great states in the Middle West make all possible progress with our state organizations, and let us get acquainted as states with each other; Minnesota, Michigan, Ohio, Indiana, Illinois, Iowa, Tennessee, they are all ready. Whatever the next year develops, we shall be ready to deliberate and to reach conclusions. If we can speak with unanimity our findings will be far reaching in the nation.

There are certain fundamentals to keep before us in coördinating existing organizations and creating new ones:

1. An organization must possess virility. It must have work to do, it must be provided with means to do its work and it shall be closely knit together.

2. Work shall be divided according to functional ability; thus: (a) Employment and registration of engineers—American Association of Engineers and local society; (b) technical—national society and local society; (c) civic affairs—local society, American Association of Engineers, council; (d) publicity—national, probably American Association of Engineers.

3. There shall be no duplication of effort, which is an economic waste.

4. The plan must be workable.

5. There must be coöperation, teamwork, enthusiasm, loyalty.

Palo Alto Keeps Refuse Disposal Records

So few cities, large or small, keep useful records of the cost of garbage and refuse collection and disposal, that the following statement from the 1916-17 annual report of the Board of Public Works, Palo Alto, Calif., is of particular interest:

OPERATIONS OF PALO ALTO REFUSE DESTRUCTOR

Receipts from refuse collection		$6,879.95	
Penalties		18.50	
Sundry material, etc., sold to city departments		190.00	
Miscellaneous receipts		159.80	
			$7,248.25
Destructor plant wages	$1,909.65		
Power	89.04		
Maintenance	15.99	$2,014.68	
Refuse collectors' wages	3,778.63		
Repairs	3.00	3,781.63	
Salaries	480.55		
Printing and stationery	119.00	599.55	
Bond interest		823.09	
Depreciation		700.13	$7,919.08
Net loss			$670.83
Remarks:			
Number of furnace grates in incinerator			2
Total grate area (sq. ft.)			33
Weight of refuse burned (tons)			2,011.61
Weight of residual clinker, ash, etc. (tons)			400.18
Percentage of residue			19.9
Average amount of refuse burned per hr. (tons)			0.75
Average amount of refuse burned per sq.ft. of grate area per hr. (lb.)			45
Total weight of water fed to boiler (lb.), not including water for cleaning and blowing down boilers			779,539
Water evaporated per lb. of refuse (140 lb. per sq.in. boiler working pressure)			0.19
Horses cremated, 8; dogs cremated, 28; cows cremated, 1.			
Average water per ton of refuse, lb			1,088
Average combustible matter per ton of refuse, lb			512
Average non-combustible matter per ton of refuse, lb			399

The Palo Alto destructor is of the Dundon high-temperature type (*Engineering News*, Mar. 4, 1915, p. 432, and May 27, 1915, p. 1040). It has a nominal daily capacity of 30 tons of mixed refuse and cost about $18,000. The population of Palo Alto is estimated at 5900. M. A. Buchan is chairman of the Board of Public Works of Palo Alto.

High Multiple-Arch Concrete Dam for Salt Lake City Water-Supply

Washed Gravel and Sand from Excavation Used in Mixture—Wood Forms Built in Small Panels—Cost $100 per Acre-Foot of Storage

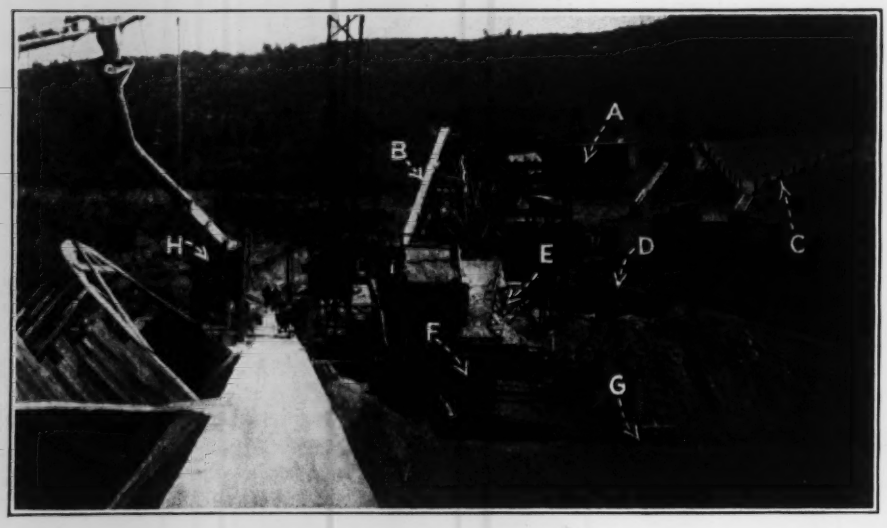
MULTIPLE-ARCH reinforced-concrete dams are growing in number in the Far West. One of the largest, which will eventually rise 145 ft. above its rock foundation, is partly completed in connection with the water supply of Salt Lake City, Utah. It is intended to store a billion gallons of flood water to meet emergency supply conditions in the city. The dam, known as the Mountain Dell Dam, has reached a preliminary height of 100 ft., which gives 300,000,000 gal. storage.

In arid regions the amount of storage available is the most important feature. For present needs the city's rights to the natural flow of City Creek, Emigration Creek, Parley's Creek and Big Cottonwood Creek are sufficient to supply the average consumption of 24,000,000 gal. and the maximum of 34,000,000 gal. daily. This applies to all seasons, except for a period of about eight weeks from the end of July, when the natural flow is low, and about the same length of time in December and January, when the streams are affected by freezing.

With the completion of the first unit of the Mountain Dell dam to a height of 100 ft., giving 300,000,000 gal., the total reservoir storage for the city will be 850,000,000 gal. Probably the cold weather shortage is the more serious, for last winter $2500 was spent in keeping City Creek open. All the creeks are riprapped with stone, and are cleared of brush for an aggregate of 14 miles above the various intakes to the gravity supply mains leading to the city.

Despite all these precautions it was necessary last winter, toward the end of a six-week period of extreme weather, to send a crew 28 miles to the Twin Lakes reservoir in Big Cottonwood Creek in order to turn on additional water. This was in zero tempera-

CONTRACTOR'S PLANT WAS LOCATED AT ONE END OF DAM



MOUNTAIN DELL DAM TO STORE WATER FOR SALT LAKE CITY

A, cement shed; B, cement slide to mixer; C, sand chute; D, incline to charging bins; E, over-size; F, to crusher; G, return of crushed rock to loader; H, concrete storage for loading buggies.

ture, with 7 ft. of snow on the ground. It took a day to go, one to manipulate the valves, and another to return. The water took three days to get to the city. Under such circumstances the Mountain Dell dam, only 13 miles from the center of the city, will be a welcome relief to the water-works officials.

Because of the seamed rock and probable leakage, a dam of the multiple-arch type was chosen, with the inclined arch rings supported on buttresses having horizontal strut-tie beams to take compression or tension. The arch rings are 120° arcs of circles, 4.1 ft. in maximum thickness at the base and 15 in. at the 100-ft. level, which is the top of the present dam. The slope is 10 on 12, and the spacing between buttress centers is 35 ft. The maximum base thickness of the buttresses is 8 ft., with a batter of 3 in. in 10 ft. vertically.

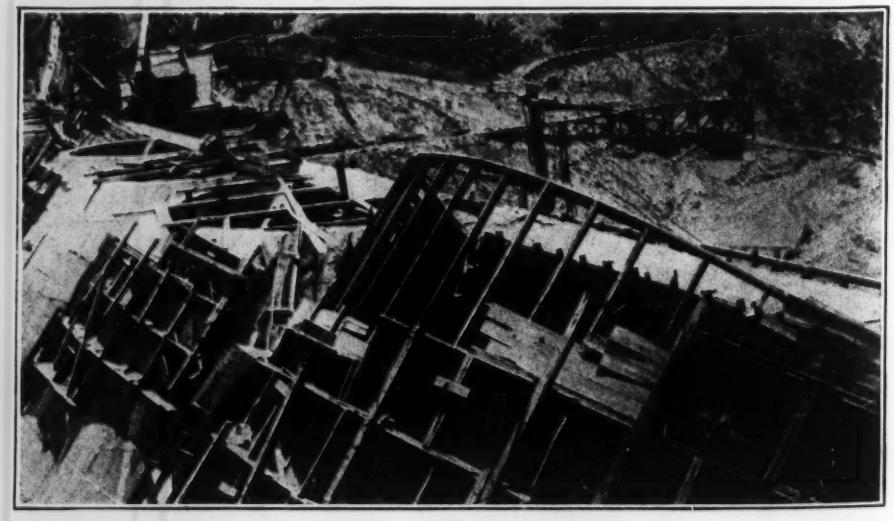
The maximum compression in the buttresses for the full height of dam is 146 lb. per sq.in., and in the arch rings it is 300 lb. per sq.in. Tests taken of the concrete during construction showed a strength of approximately 2000 lb. per sq.in. at the end of 28 days for the 1:2:4 mix in the arches and tie beams, and 1500 lb. for the 1:3:6 mix in the buttresses.

Horizontal tie beams between buttresses are spaced 20 ft. apart vertically and 29 ft. horizontally, beginning at the haunches or corbels. There are four beams at an elevation of 20 ft. above the base for the partial height, and one less at each 20 ft. interval. The steel in these ties is continuous from end to end of the dam. The beam below the 4-ft. slab section is arch-shaped, of 30-ft. radius. For the upper 16 ft. of the finished dam the arches will be vertical between buttresses.

About 10,000 cu.yd. of sand and gravel were excavated from the foundation site by a slack-line outfit, with the dead line upstream and the mast downstream. At the latter a Dull washer and separator provided concrete aggregate for the dam. From the stock pile the sand was loaded through a trap on a car which was raised on an incline to a hopper over the mixer. This was located alongside the canyon, near the east end of the dam. The gravel was pulled into a hopper by a slackline operating a Bagley bucket, and thence delivered to a washer for further cleaning and for screening. The oversize material was passed through a crusher, and with the gravel was hauled up as described for the sand and delivered to the hopper at the mixer.

A cement shed was located on the Park City branch of the Denver & Rio Grande R.R., the track of which is about 70 ft. above the elevation at which the mixer was placed. A trestle for a small car was built over the adjacent highway and a chute to the mixer provided at the end.

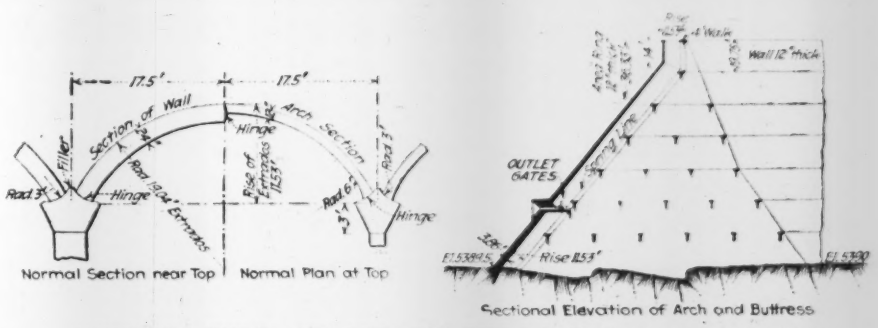
A distributing tower 125 ft. high delivered the concrete through chutes directly to the forms. A 1¼-in. cable for supporting the chutes was anchored across the dam and at the top of the tower. All machinery was electrically driven, except the steam-driven mixer. The main transmission line of the Utah Power and Light Co. crossed the canyon immediately below the site, and



FORMS USED ON MULTIPLE-ARCH DAM

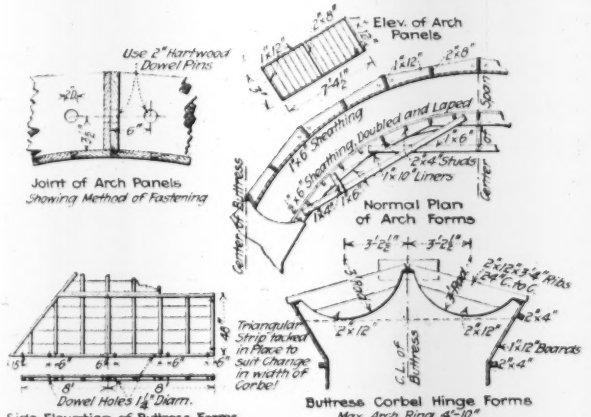
a temporary substation was installed at the east end of the dam.

For the buttresses and the outside of the arch rings, sectional panel forms approximately 5 ft. square were used. They were built up with 2 x 4-in. timbers top and bottom, through which holes were bored so that each form could be pinned to the one below. To withstand side pressure two sets of 4 x 4-in. wales were wired through to the opposite side. The corbels in the sloping ends of the buttresses, against which the arch rings seated, were circular. For these the half-round boards were covered with sheet iron. A water stop of galvanized sheet iron was placed along these joints. The seat was then painted with asphalt before the rings were poured. A hinge of the same character was also placed along the crown of the arch ring.



CONCRETE LEVELED OFF, BUT ARCH RIBS BUILT UP ON TRUE CIRCLES

For the rings, the inner form consisted of trussed liners 8 ft. apart, with vertical 2 x 4-in. ribs 2 ft. c. to c. around the arch. Two layers of 1½ x 6-in. sheeting were then laid horizontally over these ribs. The outer forms consisted of sectional panels. Cables attached to wires left on the corbels were thrown around the outside wales holding down the boards, and cinched up with a turnbuckle. This method of taking the outward thrust was not entirely satisfactory, according to the engineers, for some bulging took place which a more rigid support would have eliminated. However, an inspection by a representative of the *Engineering News-Record* when the dam was practically completed did not indicate any material bulges.


Use 2" Hardwood Dowel Pins
Joint of Arch Panels
Showing Method of Fastening
Elev. of Arch Panels
1"x6" Sheathing, Doubled and Laped
2"x4" Studs
1"x10" Liners
Normal Plan of Arch Forms
Triangular Strip Nailed in Place to Suit Change in Width of Corbel
Dowel Holes 1¼" Diam.
Side Elevation of Buttress Forms
Buttress Corbel Hinge Forms
Max. Arch Ring 4'-10"
Max. Buttress Width 8'-0"

DETAILS OF ARCH DAM

Forms for the strut-tie beams were supported from the ground level or from supports spanning strut beams lower down. This arrangement increased the cost per yard materially as compared with that of the movable form work for the buttresses and rings.

From the time bids were taken in November, 1915, until the completion of the dam in August, 1917, the cost of timber doubled, so that any extra lumber used raised materially the cost per yard of concrete. The price paid the contractor for 3400 yd. of 1:2:4 concrete for the arch rings and strut beams was $8.50 per cu.yd., and for the 4900 yd. of 1:3:6 concrete for the buttresses was $7.20 per cu.yd. The price paid for excavation of loose material was 56c. per cu.yd., and for solid rock $2 per cu.yd. The total cost of the dam was $90,000, or nearly $100 per acre-foot stored.

The design of the dam was made by John S. Eastwood, for the city. Some modifications were made under the direction of Sylvester Q. Cannon, city engineer, who also supervised the construction. Parrott Brothers Co. was the contractor.

Small Bypass Carried Water-Supply After Submerged Break

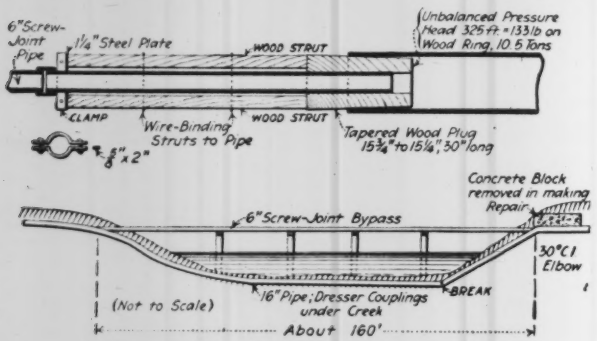
Braced Wood-Plug Reducers Between 15½- and 6-Inch Steel Pipe Carry 133 Pounds Pressure—Only 20% Capacity Reduction

BY H. A. RANDS
Civil and Hydraulic Engineer, Portland, Ore.

A RECENT break in a 15½-in. submerged pipe line in the water-supply conduit of Oregon City, Ore., was temporarily repaired by throwing a 6-in. bypass over the stream. Although the conduit at this point is under 133 lb. pressure the wood-plug reducers between the main conduit and the bypass held tight, thanks to the bracing detail used. The carrying capacity of the conduit was reduced about 20% by the use of the bypass.

The Oregon City supply main consists of approximately 13 miles of 18-in. and 12 miles of 16-in. Matheson joint pipe, constructed in 1915. (See *Engineering Record*, Dec. 9, 116, p. 700.) Up to the present winter it has given little trouble. On Dec. 18 the precipitation for the 24 hours amounted to nearly 5 in. The weather being unseasonably warm the snow was brought out of the mountains and the streams came to flood stage. The pipe line suffered to the extent of the blocking of the intake with drift and the opening of a joint under Clear Creek.

The line crosses this creek under a head of 320 ft. or 133 lb.—at only one other point is the head greater. On the left bank the descent to the creek bed is by the usual Matheson joint construction; on the right bank two 30° ells were used. The pipe in the trench under the creek was connected by Dresser couplings.



WATER-SUPPLY TEMPORARILY MAINTAINED BY 6-INCH BYPASS IN 15½-INCH PIPE LINE

The lead joint at the point where the lower end of the ell joins the pipe under the creek opened up and allowed the water to escape.

The rain continuing to hold the water at flood stage, it was decided to make a temporary repair by parting the pipe at each bank, inserting wood-plug reducers and putting a 6-in. bypass over the stream. Notwithstanding the great pressure of the water the scheme proved a success.

The only point demanding any particular care was the necessity of holding the wood plugs against the great pressure. This was accomplished by means of clamps and struts which transmitted the pressure to the sleeve and thence to the pipe, which became virtually a column. To prevent lateral buckling taking place, braces were placed at the several points of vertical support.

One of the wood-plug reducers was made with the hole for the 6-in. pipe slightly tapering and a very tight fit. The hole in the other plug was made large enough to slip the pipe through without driving, tightness being secured by calking with lead wool in a recess turned in the plug for that purpose.

The cause of the break was probably the use of elbow construction. It is likely that the great pressure caused the lower elbow to "walk" back at the time of filling the line. The travel was not enough, however, to cause leakage, and the line continued to operate until the flood cut or washed some of the material away from behind the pipe and ell and allowed the joint to open. Either this or a large log jam which came down the creek some time before the break occured may have ground into the trench and jarring the pipe caused the trouble.

In making a permanent repair it is proposed to do away with the elbows and lay the line in as on the left bank, using a Dresser coupling at the point where the present break occurred.

The slope to the summit at the point where the inside diameter of the pipe changes from 17½ to 15½ in. is 1.7 ft. per 1000. The slope to the controlling summit for the 15.5-in. pipe is 2.9 ft. per 1000. The capacity of the line under normal working conditions, as shown by Venturi meter measurements, is 3,200,000 gal. in 24 hours. The capacity of the line with bypass amounts to 2,500,000 gal.

The repair work described was done under the direction of the writer.

Alternate Freezing and Thawing Affect Concrete

Tests Show Proportionate Change in Strength Due to Reversals of Temperature After Different Storage Periods

By A. B. McDaniel
Professor of Civil Engineering, Union College, Schenectady, N. Y.

TESTS were made under the direction of the writer at the University of Illinois in 1913, 1914 and 1915 investigating the effect of temperature upon concrete The first two series were described in Bulletin 81 of the Engineering Experiment Station of the University. Results from alternate freezing and thawing are briefly set forth in this article.

All the test specimens were 6 x 12 in. cylinders and were made of Universal portland cement, clean and well graded Attica sand, and bank gravel from Attica, Ind., in the proportions of (a) 1:1:2 by weight or 1:1.2:2.2 by volume, (b) 1:2:4 by weight or 1:1.2:4.4 by volume, (c) 1:4:8 by weight or 1:4.8:8.8 by volume. The materials of each specimen were weighed out separately, dried and then thoroughly mixed by hand. All specimens were molded in cast-iron pipe forms and extreme care was taken to secure uniformity of materials and density of mass. The initial temperature of the concrete in the molding room was about 70° F.

The specimens were stored alternately in two rooms having respective temperatures of about 70° F., and 20° F. The temperature of the storage rooms were determined by daily readings of maximum and minimum thermometers placed alongside the specimens which were covered with several layers of moist sacking, which was sprinkled daily. The internal temperatures of the concrete were obtained by thermometers inserted within special specimens. At the end of the storage period the specimens were taken to the laboratory, where they were tested in a standard Olsen machine of 200,000 lb. capacity for their ultimate compressive strength.

The observed values for one group of specimens, summarized in Table I, show the effect upon the strength of 28-day specimens of an insertion of a 6-day reversal period after an initial storage period of different

TABLE I. EFFECT ON STRENGTH OF 28-DAY SPECIMENS OF 6-DAY REVERSAL PERIOD

(Compression in Lb. per Sq.In. on 6x12-in. Cylinders)

Storage Conditions	Strength			Loss of Strength					
	1:1:2 Lb.	1:2:4 Lb.	1:4:8 Lb.	1:1:2 Lb.	1:1:2 %	1:2:4 Lb.	1:2:4 %	1:4:8 Lb.	1:4:8 %
28 days at normal temperature	3,420	2,150	690	...	....	...	....	...	...
2 days at normal temperature; 3 reversals; 20 days at normal temperature	3,370	1,950	620	50	7.2	200	9.3	70	10.1
6 days at normal temperature; 3 reversals; 16 days at normal temperature	3,190	1,850	630	230	3.3	300	13.9	60	8.7
10 days at normal temperature; 3 reversals; 16 days at normal temperature	3,210	1,980	635	210	3.02	170	7.9	55	8.0
14 days at normal temperature; 3 reversals; 8 days at normal temperature	3,420	1,990	650	0	0	160	7.4	40	5.8

NOTE.—Each reversal consisted of one day in a normal temperature of about 70° F., followed by one day in a freezing temperature of about 20° F.

lengths, at a normal temperature. The relatively high values for all three mixtures at the 2-day initial storage period are accounted for by the quick setting action of the cement used for this group. With the exception of this condition, the results show a gain in strength with the length of the initial storage period.

The average values for another group of specimens, given in Table II, show that the percentage loss of strength due to alternations of temperature above and below freezing varies with the richness of the mixture, being greatest for the 1:4:8 mixture and least for the 1:1:2 mixture. In the case of the two reversals, the percentage of loss for the two shorter initial storage

TABLE II. EFFECT OF 2-DAY REVERSALS AFTER SHORT INITIAL SET AT NORMAL TEMPERATURE

(Compression in Lb. per Sq.In. on 6x12-in. Cylinders)

Storage Conditions	Mixtures	Ages							
Reversal Period / Initial Period at Normal		4 Days 4 Hours	4 Days 8 Hours	4 Days 12 Hours	4 Days 24 Hours	8 Days 4 Hours	8 Days 8 Hours	8 Days 12 Hours	8 Days 24 Hours
Normal temperature	1:1:2	1,240	1,260	1,280	1,360	1,800	1,820	1,840	1,880
	1:2:4	360	380	400	440	670	680	690	720
	1:4:8	105	110	115	125	190	195	200	220
Initial storage, 1 reversal *	1:1:2	720	800	880	1,060	.....	.....	.....	.....
	1:2:4	180	230	290	430	.....	.....	.....	.....
	1:4:8	40	50	70	110	.....	.....	.....	.....
Initial storage, 2 reversals	1:1:2	.....	.....	.....	.....	1,080	1,200	1,320	1,500
	1:2:4	.....	.....	.....	.....	200	260	340	480
	1:4:8	.....	.....	.....	.....	70	90	100	140

* Each reversal consisted of two days in a normal temperature of about 70° F. followed by two days in a freezing temperature of about 20° F.

periods is about the same for the 1:2:4 and the 1:4:8 mixtures. This apparently anomalous condition is probably due to the low rate of increase in strength of the 1:4:8 concrete during the first week. The percentage loss of strength in the case of the 1:1:2 mixture is practically the same for one and two reversals, while for the leaner mixtures, 1:2:4 and 1:4:8, the percentage loss of strength is greater for the two reversals than for the one reversal.

The observed values are summarized and expressed in loss of strength in per cents. in Table III, which gives significant information concerning the effect of alternate freezing and thawing upon the strength of concrete. From a study of the results it is believed that the following general conclusions are justifiable.

(1) In general, for any of the three mixtures, and under a uniform temperature of about 70° F. there was an increase of strength with age within the limits of

TABLE III. STRENGTHS AT VARIOUS AGES AND UNDER DIFFERENT STORAGE PERIODS AND NUMBER OF REVERSALS

(Compression in Lb. per Sq.In. on 6x12-in. Cylinders)

Initial Storage Periods	Loss of Strength in per Cent. ** 1:1:2	1:2:4	1:4:8
(One Reversal *)			
2 days	11.1	11.4	11.1
6 days	10.8	11.7	8.7
10 days	7.0	11.3	7.4
14 days	3.0	11.3	6.7
(One Reversal *)**			
4 hours	42	50	61
8 hours	37	39	54
12 hours	31	27	39
24 hours	22	2	12
(Two Reversals *)**			
4 hours	40	70	63
8 hours	33	61	53
12 hours	28	50	50
24 hours	20	33	35

* A reversal in this group consists of one day in the normal temperature room of about 70° F., and one day in the cold room of about 20° F.

** The loss of strength in per cent. is based upon the strength of specimens stored in the normal temperature room only.

*** A reversal in these groups consists of two days in the normal temperature room of about 70° F., and two days in the cold room of about 20°F.

the tests. For this normal temperature, the rate of increase in strength decreases with the age of the specimen. The rate of increase varies with the richness of the mixture. For the specimens tested, under normal hardening conditions of from 60° to 70° F. the compessive strength of the concrete subjected to a uniform temperature at the ages of 7, 14 and 21 days may be taken as approximately 60%, 80% and 95% for the 1:1:2 mixture, as 50%, 75% and 90% for the 1:2:4 mixture and as 40%, 65% and 85% for the 1:4:8 mixture, of the strength at 28 days, respectively.

(2) The loss in strength due to the alternate freezing and thawing conditions (a) decreases with the increase in the length of the initial setting period at a normal temperature, (b) increases with the number of reversals, and (c) decreases with the richness of the mixture. Where specimens received an initial storage of 4 hr., 8 hr., 12 hr. and 24 hr. the loss of strength is much greater than where the initial storage periods were 2 days, 6 days, 10 days and 14 days. Those specimens having had two reversals show greater loss of strength than those having had only one reversal for the same initial storage periods. Under similar conditions the richer mixture shows a smaller loss in strength.

(3) When concrete of a 1:1:2 mixture is stored at a normal temperature of about 70° F. for initial storage periods of 4, 8, 12 and 24 hr., the percentage loss of strength after one reversal of one day at 20° F. and one day at 70° F. may be taken as about 40%, 35%, 30% and 20%, respectively, and the same after a second reversal. For a 1:2:4 mixture these percentage losses may be taken as about 50%, 40%, 25% and 10% after one reversal and 70%, 60%, 50% and 30% after two reversals. For a 1:4:8 mixture the percentage losses may be assumed as about 60%, 50%, 40% and 15% after one reversal and 70%, 55%, 50% and 35% after two reversals. The percentage values are based on the strength of the concrete for the same ages stored at a normal temperature of about 70° F.

Be Engineering Press Agent in Your Community

IN OUTLINING a publicity program for the Iowa Engineering Society, benefit to the average engineer was emphasized by C. W. Eby, chairman of the publicity committee. These were suggested as proper lines of activity: Publicity by individuals, press publicity and increased activity by local societies. For individuals this advice is given: Optimists will be popular. Take your hard-luck stories to bed with you and get up without them. Shout the good things you know about engineers, but keep mum about the bad things. When it is for the good of the profession to tell the faults of another engineer, speak out, but stick to the facts which you know. Every boost for the engineering profession is a boost for yourself. Advertise the profession by your personal influence in your community, and build up your influence by getting into public affairs. Most engineering work in Iowa is of local interest only, and every engineer should become the profession's press agent for the vicinity. Circulars of information for persons desiring engineering services, and bulletins for members on local publicity ethics would be worth while advertisement for the society.

Subsidence Tests for Valuation Made Under Difficulty

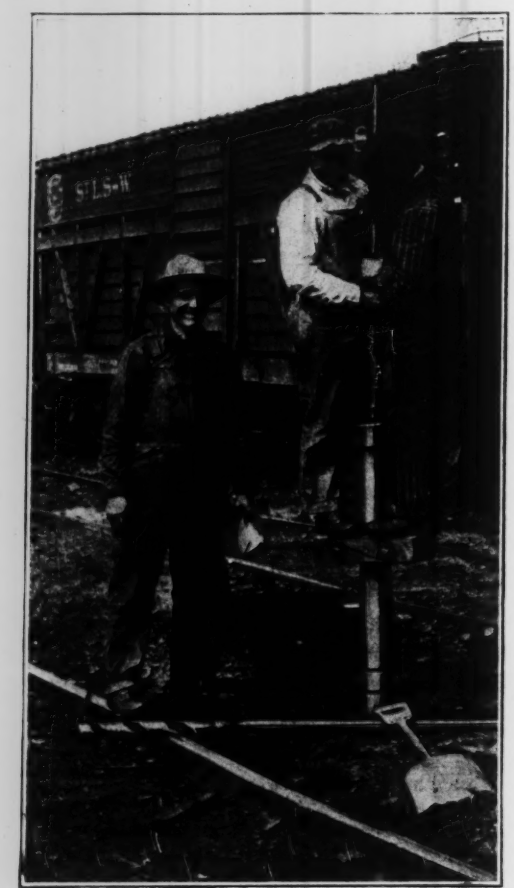
Hand Drilling in Close Quarters in Filled Ground Between Tracks at Busy Illinois Central Railroad Terminal in Chicago

TESTS of subsoil conditions by means of drill holes were made in close quarters in connection with valuation work on the Chicago terminals of the Illinois Central R.R., in order to determine the subsidence of soil and ballast and the actual depth of ballast. Difficulties were encountered from the varying and unconsolidated materials, as well as from the location of closely spaced tracks carrying heavy traffic.

The valuation department of the railway has put down 871 holes, with an average depth of 15 ft. and a maximum of 55 ft. All these holes are in filled ground, composed of sand, cinders, slag, gravel and broken stone, while in the vicinity of Van Buren St. there was débris from the Chicago fire of 1871.

Many of the holes were located between tracks, and in some cases the clearance between passing cars was only 30 in. The difficulties may be understood from the fact that the express suburban tracks are spaced only 14 ft. on centers, and have trains each way at 20-min. intervals, running at a speed of 50 miles an hour. Under such restrictions it was impossible to place a derrick.

CREW IN CLOSE QUARTERS BETWEEN TRAINS



DRILLING TEST HOLES WITH HAND AUGER

Augers were used in soft material and bar drills in slag and rock. The drill men stood on clamps attached to the casing, so that their weight helped to force it down. Where a derrick could not be used the casing was pulled with screw jacks. All work was done by hand.

The outfit included the following tools: 2-in., 4-in. and 6-in. earth augers; a spiral auger for loosening and removing stones; 2-in., 3-in. and 4-in. sand buckets; a 3-in. rock drill; a heavy star drill; a heavy bar drill about 2½ in. in diameter; 2-in. and 4-in. casing in 4-ft. lengths; 1-in. drill rods in 6-ft. lengths; two 18-in. pipe wrenches; two 24-in. chain wrenches, and a double block and line with 100 ft. of ¾-in. rope. The earth augers were of various types—chisel-bit augers for clay and hardpan, pod augers for boring and removing core and ribbon augers for general boring. The various tools were threaded to fit 1-in. pipe, and were used with short sections of pipe.

In sand and clay the earth augers were used. In sandy layers which would not hold in the auger it was necessary to use the sand bucket, or sometimes sufficient clay was placed in the hole to make the sand stick together so that the auger would lift it out. In drilling through slag and loose rock, the bar drill was used to drive the material out of the way so that the casing would follow down.

For each hole samples were kept of the formations encountered, and a log was made showing the formations and the water level. All holes were deep enough to penetrate below the natural surface of the ground. They were drilled in lines at right angles to the tracks, the number of holes being sufficient to determine the contour of the natural surface. The cost averaged 21c. per foot of hole drilled.

The crew employed consisted of an experienced driller and two laborers, supplied with a combination camp and tool car. One end of the car was fitted up for sleeping quarters and the preparation of meals. The other end was equipped with a vise, work bench and threading tools for making repairs to the drills and drilling rig. On this terminal work blacksmithing was done at convenient shops, but for work out on the road it has been suggested that it would be advisable to provide a small forge and anvil in the car. The work was done under the direction of the valuation department of the Illinois Central Railroad.

Adopt Belting and Rolling Methods for Concrete Roads

District Engineers of Illinois Highway Department Find Differences in Practice Due to Local Conditions

By H. E. Bilger

Road Engineer, Department of Public Works and Buildings, Springfield, Ill.

MINOR differences of opinion concerning the particular kind of roller and belt, as well as variations in the methods of using them to finish concrete roadways, were brought to light at a recent conference of the engineers in charge of the seven highway districts of Illinois, called for the purpose of evolving specifications that would result in the desired class of work. Upon investigation, however, it has been found that these differences are due principally to variations in humidity, temperature, character of aggregates (whether gravel or crushed stone), experience of the workmen and other factors mainly of local or particular nature.

The practice of finishing concrete roads by rolling and belting had become quite general in Illinois in the latter part of the construction season of 1917. The finished surfaces have proved so satisfactory and the method so economical that it was decided to require the roller and belt finish on all concrete road work next season. From notes taken at the above mentioned conference I have written the specifications below, which represent the concensus of the seven district engineers.

Specifications Will Be Used This Year

They will be incorporated into the revised edition of the department's specifications for concrete roads and will therefore be used in the construction season of 1918. The new specifications follow:

"After the surface of the concrete pavement has been struck off to the proper cross-section, it shall be finished by rolling and belting. The roller and belt shall meet with the approval of the engineer.

"The belt shall be of canvas-rubber composition, from one to four-ply, and shall have a width of from 6 to 10 in., and a length at least 2 ft. longer than the width of the pavement. Preferably two belts of different weights should be used, the lighter one being used for the last belting.

"The roller shall be of smooth steel from 8 to 12 in. in diameter and shall have a total length of at least 4 ft., but preferably 6 ft. The weight shall not exceed ¾ lb. per inch of length for a roller 8 in. in diameter, nor 1 lb. for a roller 12 in. in diameter. For roads not more than 15 ft. in width, the roller may be operated by a handle so designed and used as neither to increase nor decrease the pressure coming upon the concrete from the roller. For roads of greater width, the roller should be operated preferably by ropes.

"Immediately after the surface of the concrete pavement has been struck off with a template, it shall be belted over once with a combined crosswise and longitudinal motion, using long, vigorous strokes of the belt. At this belting the longitudinal motion shall be slight, but it may be increased in succeeding beltings. Care shall be taken not to work the crown out of the pavement nor to permit the edges of the belt to dig into the surface of the concrete.

"After an interval of 10 to 20 min., or as much longer as the engineer directs, the roller shall be operated slowly transversely from one edge of the pavement to the other, and then back over the same area. A one-half lap shall then be made and the rolling continued as before until the entire surface has been rolled. In moving the roller to make the lap, great care shall be taken not to mar the concrete.

"Immediately after the rolling, the surface shall be belted a second time, and about 15 min. later, or as the engineer directs, it shall be rolled as before.

"Just before the concrete obtains its initial set, the surface shall be given a finish by a final belting in order to produce a uniform surface of gritty texture. This belting shall be of short, rapid, transverse strokes having a sweeping longitudinal motion.

Long and Short Handled Floats

"The use of a short handled wooden float as a substitute for the belt will be permitted only by the written authorization of the engineer. If such permission is granted, the finishing shall be carried on from a suitable bridge, no part of which shall come in contact with the concrete. The use of a long handled wooden float is specifically prohibited.

"The edges of the pavement shall be finished carefully with an edger of about 1 in. radius."

[There are differences of opinion as to the application of the roller and belt as Mr. Bilger states. In specifications suggested by the Portland Cement Association the rolling is to be completed before the belting is begun, the idea being to remove all excess water by the roller and use the belt only as a finisher. Four or more rollings are advised, operating the roller at such an angle with the center line of the pavement that it advances along the pavement about 2 ft. for each time across. The time interval between rollings is to be from 15 to 40 minutes.

After the rolling has been completed two applications of the belt are called for. For the first, vigorous strokes at least 12 in. long are to be used, the longitudinal movement along the pavement being very slight. The second application is to be given immediately after the water glaze or sheen disappears. The stroke is to be not more than 4 in., and the longitudinal movement, almost a sweep forward, is to be much greater than for the first belting.—Editor.]

Port Terminals for War Transportation Being Built

Contain Large Standardized Timber Warehouse Units and Open Storage Spaces—Filled from Cars or Trucks and Emptied by Tractor-Trailers to Ships

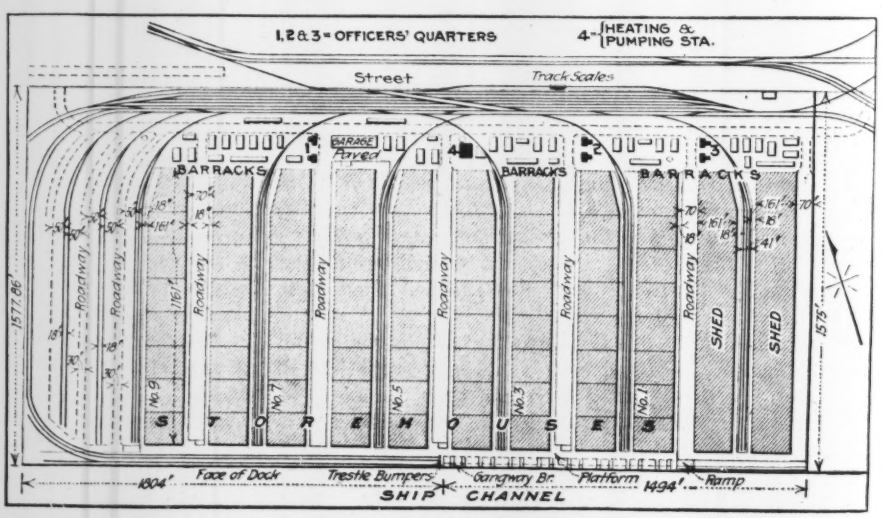
WAREHOUSE facilities for the storage of war materials to be sent overseas are being enormously increased under the direction of the cantonment division of the quartermaster general's office of the War Department. Construction is already well under way on one of the port terminals and on several of the interior depots and a large designing force is engaged in the preparation of plans on many others. Practically all of the projects are distinguished by their extraordinary size, unprecedented in the freight handling structures of this country, and by the type of construction which permits early completion.

The whole system of getting war material across to France is designed on a plan recommended by the storage committee of the Council of National Defense, of which Francis Lee Suart is chairman, and accepted by the Secretary of War. This plan provided first a series of interior depots of large capacity and situated at points of easy railroad access to large manufacturing centers, and second, a series of port terminals located on tidewater, either directly reached by oceangoing vessels or within lighterage distance to such vessels. To the interior depots will be brought, generally by rail, but where possible by motor truck, the products of the factories in the district controlled by the depot, forming there a reservoir from which can be fed the terminal warehouses. The interposition of this interior depot in the route from factory to port terminal was needed to relieve the rail and terminal congestion which, together with the lack of ships, has caused so much trouble in recent months.

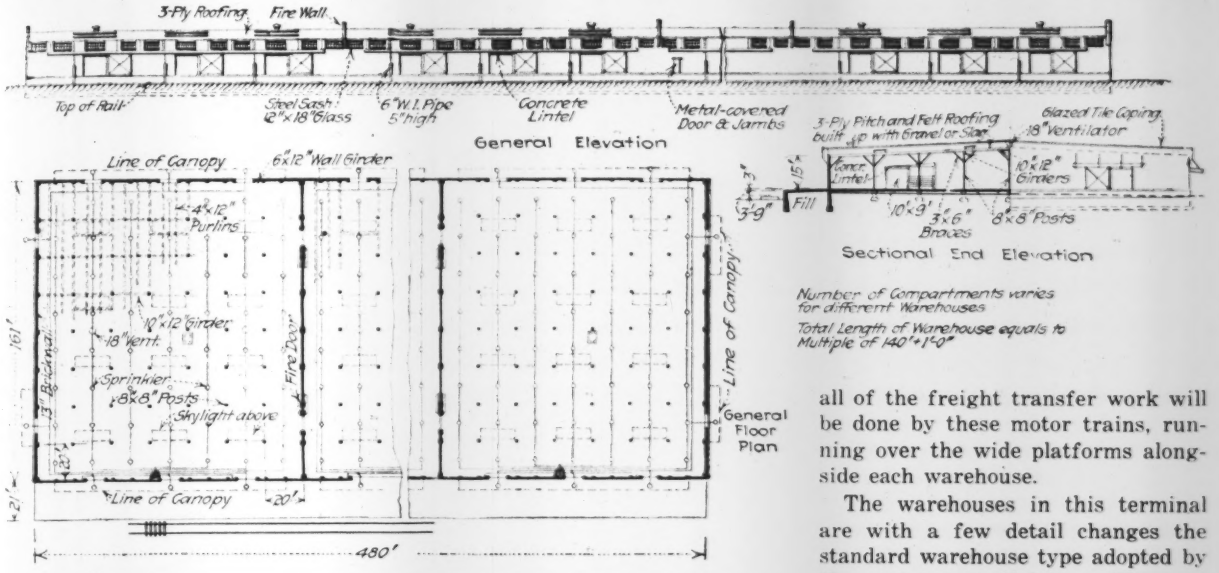
In order to permit the producing factories to get rid of their goods as soon as possible and so prevent congestion at those centers, it was necessary to build the interior depots first. Consequently contracts were early made at the important interior factory centers, without regard to any standardization of design. These structures then are of different types, depending upon the governing conditions of availability. Thus at St. Louis a very large reinforced-concrete building is being erected, a permanent structure which will probably be used for quartermaster's stores after the war. At Chicago a contract has been made with the Central Manufacturing District for a building which will be used by the army as long as needed and will then return to the control of the district, which operates a number of such buildings for private use. In Pittsburgh a contract has been made with the Austin Co., of Cleveland, and they are building warehouses of the rapid construction steel frame type in which they are specializing. For most of the interior warehouses that remain it is expected that a standardized wood-frame structure will be adopted. This standard has been developed for the port-terminal warehouses, as described later on in this article, and is well adapted to the interior warehouse, particularly where use only for the duration of the war is required. A group of such buildings is now being put up at Philadelphia, at a location convenient of access by motor-truck from the supplying factories in that district and to the port terminal on the near-by Delaware River.

It is not thought desirable at the present time to specify by location the various port terminals under construction. It is permitted, however, to give in some detail the structural and freight handling features of two of these terminals as an indication of how these two problems were met. One of these terminals is being built; the other is just being started and the detail plans are subject to change.

One of these terminals is shown. This occupies a level tract extending about 3800 ft. along a ship channel which will have an eventual depth of 20 ft. and reaching back about 1600 ft. to a wide road, on the other side of which are tracks connecting with a main-line railroad half a mile away. While the channel is deep enough for fair-sized ocean vessels the terminal is within the lighterage limits of a large port and it is expected that most of the freight will be handled to barges lying at docks along the channel. On this 160-acre tract there will be located two open sheds, each 1100 x 160 ft., nine warehouses, each of the same area, an open storage space approximately 500 x 1200 ft., quarters for the stevedore troops and a large entering ladder of tracks for car sorting.



LARGE TERMINAL FOR OVERSEAS WAR FREIGHT HAS TIMBER WAREHOUSES AND OPEN SHEDS AT RIGHT ANGLES TO SHIP CHANNEL

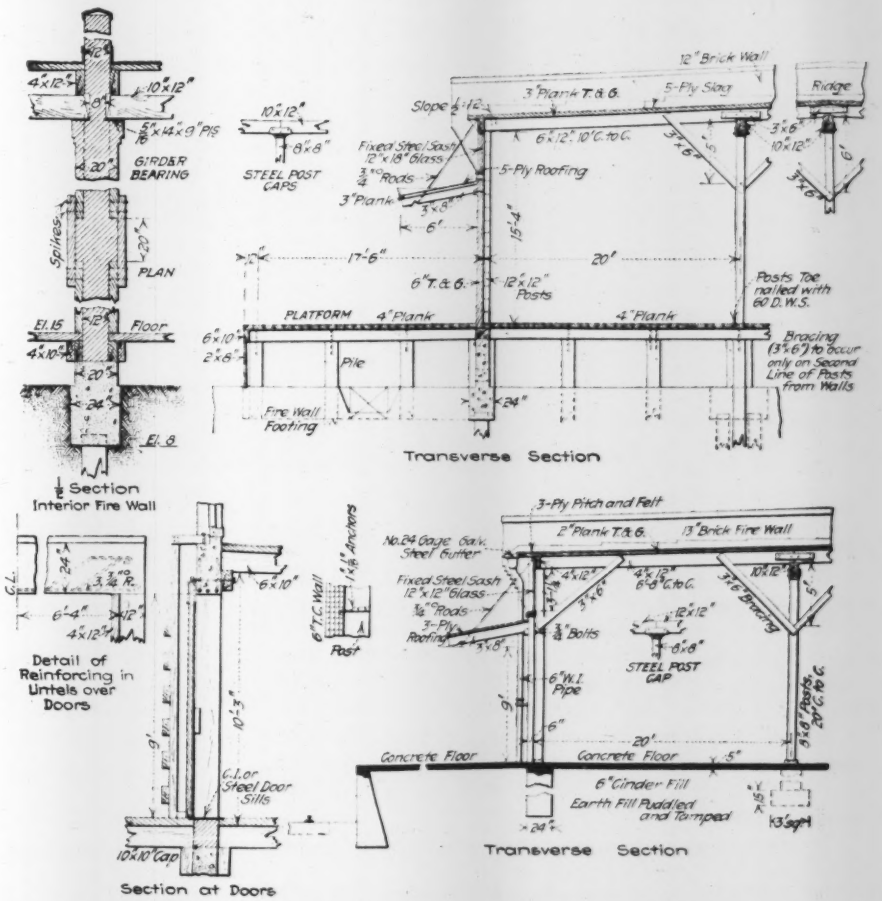


TIMBER WAREHOUSES BEING BUILT IN STANDARDIZED UNITS

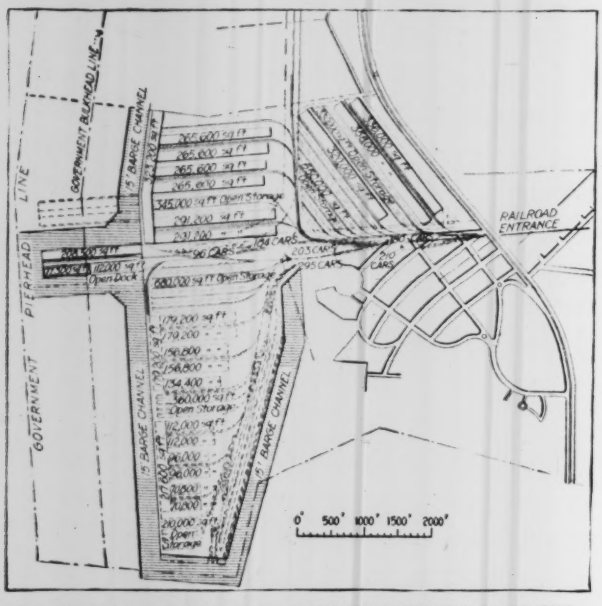
Freight cars will enter the terminal at either end of the ladder, in which the cars will be sorted and taken either to the open storage space at one end of the yard or to the tracks which run into each group of two warehouses or open sheds. Freight brought in by motor truck enters a roadway at either end of the yard and reaches the warehouse by the road which parallels each warehouse on the side opposite the railway tracks. Railway cars are emptied by hand onto small motor tractor trains, which can run directly from a box-car floor onto the warehouse platform and into the building, or in case of heavy material by means of locomotive cranes operating on the third track between the warehouses. In the open storage locomotive cranes will be used exclusively. Tracks also loop around one end of the yard and parallel the dock, so that in some cases direct transfer from car to barge can be made by locomotive cranes running on the adjoining track.

The upper end of the dock is at a high level with paralleling tracks for the direct transfer just noted. The lower end is lower, with ramps running down from the platform level to permit the driving of the motor tractor-trailer train from the warehouse floor to the barge. It is expected that practically all of the freight transfer work will be done by these motor trains, running over the wide platforms alongside each warehouse.

The warehouses in this terminal are with a few detail changes the standard warehouse type adopted by the cantonment division. They are of wood-frame construction of the simplest form. Each warehouse is 161 ft. wide and in multiples of 140 ft. in length, a brick firewall separating the 140-ft. units. In this particular layout the soil conditions were such as to require pile footings not only under the concrete footing walls which extend along the



TIMBER DETAILS SHOW SIMPLE FORM OF CONSTRUCTION



TENTATIVE LAYOUT OF ANOTHER TERMINAL SHOWS SIZE OF PROJECT

whole length and ends of the buildings but also under the intermediate posts and still further under the floor joists to split up the 20-ft. spans into three. In the typical design, also shown herewith, the posts are carried on concrete piers and the floor rests on a fill and requires no intermediate support.

The outside walls of the warehouse are of 6-in. hollow tile tied in to 12 x 12-in. tile pilasters spaced every 20 ft. in the design, though in construction a timber post will probably be substituted, as is shown in the detail cross-section. Intermediate posts are 8 x 8-in. timbers, carrying on cast-iron caps 10 x 12-in. stringpieces which support the roof girders. In one design the roof is of 6 x 12-in. timbers spaced 10 ft. on centers, but later designs call for 4 x 12-in. sticks, 6 ft. 8 in. on centers. All roof beams are braced to the posts as shown. The roof, slightly pitched from the ridge, is of 3-in., or in the later design 2-in., plank with a pitch and felt or slag roofing.

The floor, where carried above the ground, is of 4-in. plank extending through the warehouse onto the plat forms. Where the fill is high enough a 5-in. concrete floor will be laid. Natural lighting is had by frequent windows in steel sash above the platform canopies and by skylights, either eight or twelve to each 140-ft. unit. One sliding door is in each half of each end and side doors are spaced in alternate 20-ft. longitudinal bays. Fire doors are also placed in each half of each firewall. These firewalls are of brick and extend from a continuous concrete footing wall to about 3 ft. above the roof. As an additional protection against fire spreading the wooden canopies are stopped short of each firewall. A complete sprinkler system covers all the warehouses and fire mains and fire-fighting apparatus are provided.

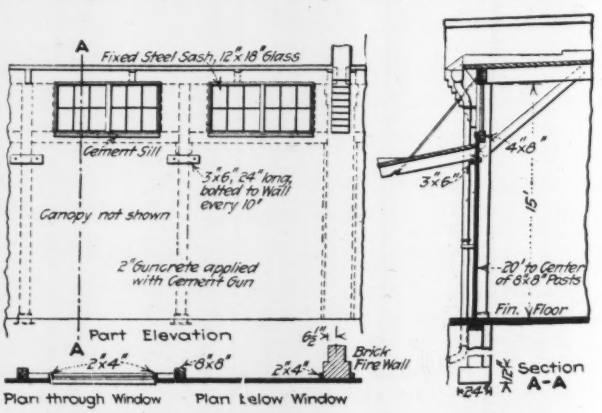
The open sheds are of the same general type as the warehouses as to roof and posts.

The construction of the terminal illustrated is complicated by the barracks facilities that have to be provided. This not only adds considerable construction, but requires extensive sewer, water and lighting equipment, which the warehouses could do without.

A variation in the type of warehouse is to be tried in one of the terminals about to be started. This will consist in the use of concrete walls placed with the cement gun, as shown in detail in one of the drawings. In the main this warehouse will be the same as the others shown and described here, but the walls will be of 2-in. mortar, driven with the cement gun on the wire-mesh backed on 8 x 8-in. posts spaced the regulation 20 feet.

Another of the port terminals about to be started but in which the complete design has not yet been approved is shown in one of the drawings. Complete details of this layout cannot now be published, but the tentative plan shown is given to indicate to the engineering public what an enormous project is involved. Here there is a tidewater river with 18 ft. of water up to the bulkhead line. The center of the waterfront has a pier extending out about 1500 ft. and carrying nearly 400,000 sq.ft. of shed storage. This pier is approached directly from the near-by main-line railroad, which passes through the sorting ladder to reach the pier. On either side of the pier are to be standard warehouses paralleling the dock wall at which lighters will tie, and running at right angles into the marginal warehouses are rows of other standard warehouses laid out in a similar manner to those shown for the terminal already under construction. Back of this group of warehouses and extending diagonally from the main-line ladder is a third group of standard warehouses and open storage space. The largest of these warehouses has 358,400 sq.ft. of storage space under one roof and on one floor; that is, it has 16 of the 160 x 140-ft. units and is 2240 ft. long. As a beginning it is intended to build the diagonally placed warehouses and the group shown above the pier on the plan, leaving the groups shown dotted for future development as needed. The whole project present and contemplated contains about 177 acres of storage space, 114 acres of which will be under sheds.

The design and construction of all the warehouse and terminal work described here is in charge of the cantonment division of the quartermaster general's office, of which Brig.-Gen. I. W. Littell, U. S. A. was the head. He has just been succeeded by Lt. Col. R. C. Marshall.



CEMENT-GUN CONCRETE WALLS SUBSTITUTED FOR TIMBER IN TWO EXPERIMENTAL WAREHOUSES

Engineering Council Urges More Pay for Railroad Men

Says Despite Higher Cost of Living Civil Engineers Have Had Few Increases Since 1914 and Are Underpaid

A COMMUNICATION relative to the compensation of railroad civil engineers was submitted last week to the Railroad Wage Commission by the Engineering Council. The council pointed out that railroad civil engineers have received little recognition of the increased cost of living during the past three years, and showed by a table how unfavorably their average pay compares with that of other groups of railroad employees. The council urges that the condition be rectified, and offers its services in the securing of more data.

Following is the major part of the communication:

It has been stated to the Engineering Council that except in a comparatively small number of individual cases no increase in compensation of technical employees of railroads have been made since 1914, while within the same period large increases have been granted to skilled and unskilled labor. Owing to the depreciation of the dollar, these technical employees have therefore in reality suffered a great diminution in income. Applications for increases, even on the basis of the increased cost of living, have been refused them, on the ground that they can be replaced and must stand war privation, although no such theory has been applied to the trainmen, who equally as individuals can be replaced. As a class, neither trainmen nor technical employees can be replaced at present. The discrepancy in compensation is indicated by such few statistics as we have in hand. Some of these are given below.

Of 31 classes of railroad employees concerning whom information is given in a letter dated Feb. 13 from the Bureau of Railway Economics, quoting the Interstate Commerce Commission report for the year ended June 30, 1915, 12 classes on the average received more and 18 classes less than the assistant engineers and draftsmen; the highest paid class (road passenger enginemen and motormen) received nearly 100% more. Road freight enginemen and motormen, and road passenger conductors were paid about 66% more; foremen, boilermakers, brakemen, firemen and helpers received approximately the same pay as the assistant engineers and draftsmen (some a few dollars more and others a few dollars less). It is highly probable that if figures for 1917 were available, it would be found the pay of the assistant engineers and draftsmen was much less in proportion than in 1915. The data referred to for 1915 are given in Table I.

TABLE I. AVERAGE COMPENSATION OF THIRTY-ONE CLASSES OF RAILROAD EMPLOYEES FOR YEAR ENDED JUNE 30, 1915

Class	Average Number	Average Pay per Mo.
Assistant engineers and draftsmen	7,144	$92.88
M. W. and S. foremen	6,171	92.08
Section foremen	37,356	63.89
Gang and other foremen, M. E. Dept.	14,205	97.09
Machinists	32,972	85.81
Boilermakers	10,739	89.53
Blacksmiths	6,978	77.00
Carpenters	43,361	63.83
Painters and upholsterers	8,761	63.01
Electricians	5,559	78.34
Airbrakemen	4,781	67.54
Train dispatchers and directors	4,686	131.35
Telegraphers, telephone and block operators	18,361	66.46
Telegraphers and telephoners operating interlockers	7,425	68.44
Telegrapher clerks	9,065	66.22
Agent telegraphers	18,597	68.27
Station agents	14,168	76.61
Yard engine men and motormen	12,192	127.73
Yard firemen and helpers	12,425	76.09
Yard conductors	11,716	112.84
Yard brakemen	30,523	95.33
Road freight enginemen and motormen	23,830	152.58
Road freight firemen and helpers	24,834	93.72
Road freight conductors	19,756	131.33
Road freight brakemen and flagmen	49,483	85.65
Road passenger enginemen and motormen	11,817	175.76
Road passenger firemen and helpers	11,411	106.29
Road passenger conductors	9,936	151.54
Road passenger baggagemen	5,499	86.47
Road passenger brakemen and flagmen	13,560	84.89
Other road trainmen	3,742	70.00
Total and average	491,053	$91.55

Table II gives a comparison between salaries paid a few engineers and draftsmen in the employment of one of the most important railroad systems of the country having its terminus in New York City and their compensations in positions to which they went from the railroad office.

TABLE II. RELATIVE SALARIES BEFORE AND AFTER, OF A FEW ENGINEERS WHO LEFT RAILROAD SERVICE

Description of Railroad Position	Railroad Salary	Description of Industrial Position	Industrial Salary
Assistant engineer erecting power substations	$160	In charge of erecting nickel reduction plants	$400
Chief draftsman	135	Chief engineer, explosives company	325
Draftsman and assistant engineer in charge of construction	105	Assistant superintendent, power plant	275
Assistant engineer	160	Consulting engineer of wire company	350
Assistant engineer	160	Designing engineer for chemical company	200
Draftsman	100	Engineer, U. S. Engineers	121
Assistant engineer	135	Ensign, U. S. N., in charge of projectile inspection	175

The table of averages, the general statement and the few specific examples given above must, of course, be considered in connection with many other data. Local conditions affect rates of pay. Railroad managements differ in their policies on this matter; some have fully or at least in a measure during the past year and a half, met the conditions which have arisen. Rates of pay for steady employment with a railroad company cannot be directly compared with rates for industrial engagements, often of limited duration and involving extra expenses. All the necessary information is doubtless subject to your call. The Engineering Council may be able to assist in collecting, supplementing and analyzing the data especially relating to civil engineer employees. It offers its services. Its desire is that the compensation of technical employees of the railroads may receive full consideration and a fair determination.

In conclusion, we would bring to your attention the fact, which must be known to you, that upon the intelligence, skill and efficiency of the technical engineers the maintenance, operation and progress of the country's railroad systems largely depends. These men deserve just compensation. In order to inspire them to the services which will yield the highest benefits to the community as well as to the railroads, they should receive liberal pay. An increase in their compensation is urgently called for by circumstances at this time.

Sewers Cleaned After Trees Had Been Cut

After sacrificing handsome shade trees in a vain attempt to prevent sewer clogging by roots, the City of Goshen, Ind., had the roots and other debris removed by the Turbine Sewer Machine Co., Milwaukee. After the trees had been cut down an unsuccessful attempt was made to kill the roots by boring holes in the stumps, pouring in acid and plugging the holes.

Double-Deck Railway Bridge Over Kansas River With Thin Floor Construction

Part of High Line, New West Entrance Route to Kansas City Union Station—Four-Track Capacity Provided by New Bridge Built Around Old—Ballast Floor on Timber Decking—Pin-Connected Floorbeams

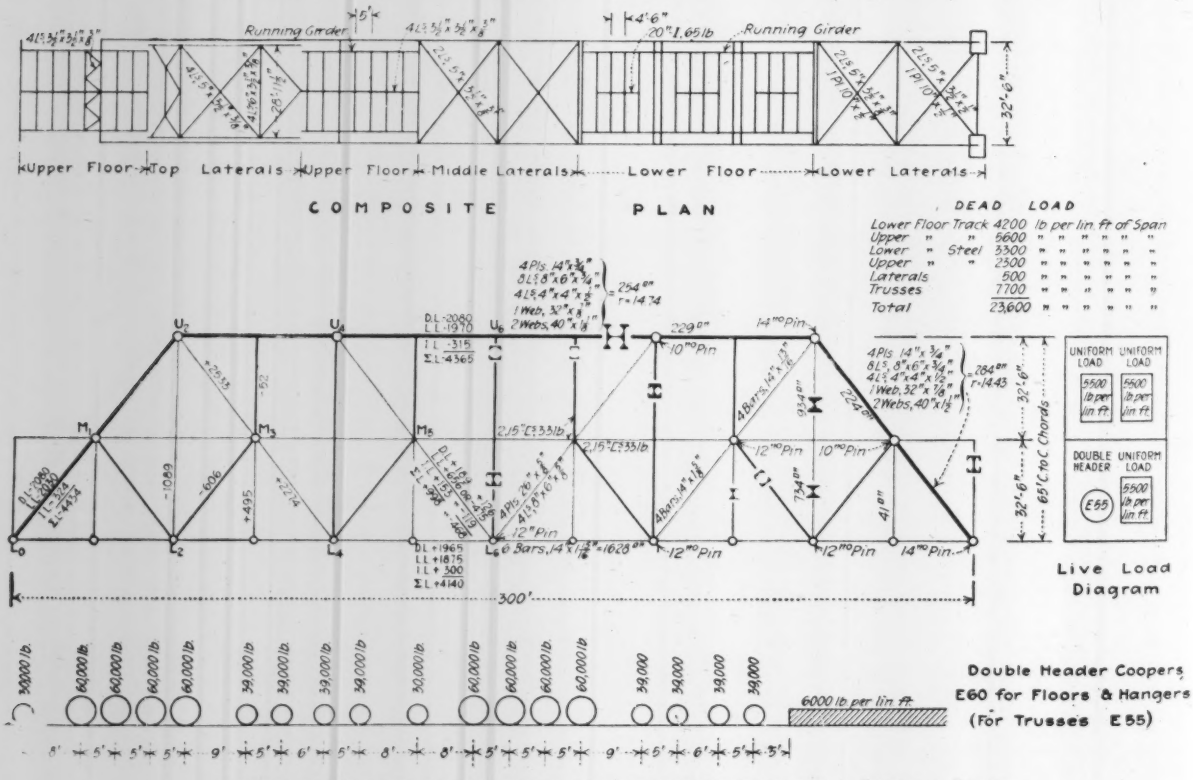
By F. W. Epps

Formerly Assistant Office Engineer, Kansas City Terminal Ry. Kansas City, Mo.

ADAPTATION to special conditions of service and of erection governed the design of the double-deck bridge by which the Kansas City High Line, described in last week's issue, crosses the Kansas River. The bridge replaces a single-track structure still in excellent condition but inadequate in track capacity for the new approach service. As traffic had to be maintained without interruption, it was necessary to erect the new structure around the old one. Quite unusual truss proportions resulted. The clearances further necessitated extremely shallow floor construction. The Santa Fé type of ballast floor on timber decking is used, but the framing involves floorbeams connected to the posts by pins, carrying longitudinal girders and secondary crossbeams. The bridge is also noteworthy because three grades of steel are used in its main members: Ordinary steel, high-carbon steel, and nickel steel.

The new structure, with two tracks on each deck, will carry on its upper level passenger trains from the West running into the new Union Station over the High Line viaduct, and on its lower level through and local freight trains from existing surface tracks. It is on the site of the Belt Line bridge built in 1907 by the Atchison, Topeka & Santa Fé Ry., and uses the old substructure with minor changes.

The first bridge over the Kansas River at this point, built in 1883, consisted of four wood and iron Pratt trusses of 180-ft. span. This bridge was washed out during the big flood of 1903, and traffic was handled over another bridge for several years. Its successor, the Santa Fé bridge, had two 300-ft. spans and at the west end a short trestle approach; its substructure was designed originally for a single-track bridge, but was changed to provide for future double-tracking. The piers were sunk about 40 ft. through sand and gravel to cemented boulders by the penumatic process. The two spans were subdivided Pratt trusses, mainly pin-connected but with a few riveted panel points. The panel length was 25 ft., the truss depth 46 ft. at midspan and the truss spacing 18 ft. center to center. A shallow floor system was used, in order to have the clearance line of the bridge as high as possible without raising the existing track grade. The floor was of ballast on an untreated wooden deck carried on 18-in. I-beams spaced 20 in. center to center, resting on the bottom flanges of 48-in. running girders hung below the bottom

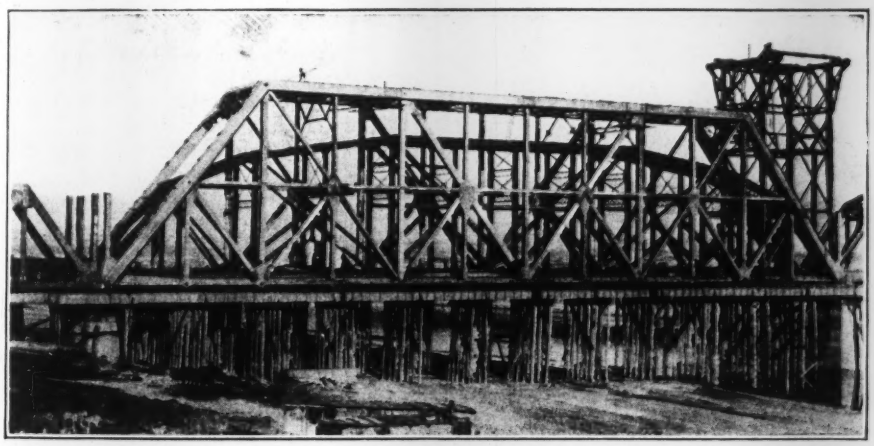

Running Girder
Running Girder
Upper Floor
Top Laterals
Upper Floor
Middle Laterals
Lower Floor
Lower Laterals
COMPOSITE PLAN
DEAD LOAD
Lower Floor Track 4200 lb per lin ft of Span
Upper " " 5600 " " " " "
Lower " Steel 3300 " " " " "
Upper " " 2500 " " " " "
Laterals 500 " " " " "
Trusses 7700 " " " " "
Total 23,600 " " " " "
300'
Live Load Diagram
UNIFORM LOAD
DOUBLE HEADER
E55
6000 lb per lin ft
Double Header Coopers E60 for Floors & Hangers
(For Trusses E55)

STRESS SHEET OF 300-FT. SPAN HIGH LINE BRIDGE OVER KANSAS RIVER

chord and riveted to the lower ends of the posts. The type of truss to be used for the long spans was determined by three conditions. The length of span was established at 300 ft. by the existing piers. The depth of truss was established at 65 ft. by two 23-ft. clearance diagrams, two floor systems and the sway bracing. The shallow lower floor necessary to keep above the clearance line set by the Kaw Valley Drainage Board required short panel lengths, so 25 ft. was chosen, the same as the panel length of the old bridge. As the depth was greater than one-eighth of the span nothing could be gained by increasing the depth at the center of the truss and hence the top chord was made straight. With these dimensions established the truss fell very naturally into the type shown.

The short span to replace the old trestle approach was made as nearly like the lower half of the 300-ft. spans as possible, in order to give a uniform appearance to the entire bridge. Its length was established at 132 ft. by the location of the harbor line, and a panel length of 22 ft. was adopted.

Complete estimates of the 300-ft. span were made on three combinations of metals:



THIS 1100-TON BRIDGE, ONLY TEN YEARS OLD (SHOWN ABOVE) REMOVED TO MAKE WAY FOR FOUR-TRACK HIGH LINE BRIDGE (LOWER PICTURE)

(1) Top chord high-carbon steel, eyebars nickel steel, and all other members of structural steel; (2) top chord and eyebars nickel steel and all other members structural steel, and (3) all members structural steel. The results showed that while the second gave the lightest span, the first type was cheapest, and it was therefore chosen.

The top chord and end posts of the 300-ft. span are of high-carbon steel. The bottom chord and main diagonals are eyebars of nickel steel. All pins except those for floorbeams are nickel steel. The parts which support the hanger at U2 are forged steel. The specifications governing the rolling of the steel were as tabulated herewith.

The loadings, stresses and sections are typically represented by the condensed stress sheets reproduced. The live-load was Cooper's E60 on both tracks for floor system, subhangers and subdiagonals, and Cooper's E55 at the specified unit stresses, or Cooper's E80 at unit stresses increased 25% for the trusses. This last condition made all parts of the truss of equal strength should heavier train loadings be used. Wheel loadings were considered on only one track, and uniform loads on the three others, as indicated by diagram on the stress sheet. This was done to allow for the fact that the upper deck does not carry the heavy freight engines and the traffic on the lower deck is very slow, due to track crossings at both ends of the bridge.

The H-section is used for the end posts and top chord of the 300-ft. span, having been decided on after a careful investigation of several types. The two most important considerations are: First, the symmetry of section about both axes, which reduces shop and drafting work and produces a more uniform distribution of stress over the entire section; second, the very satisfactory results of tests of high-carbon steel H-chords made for the American Bridge Co. by the Bureau of Standards in 1914.

The top chord and end post members all have milled butt splices with one another, but are pin-connected to the other truss members. A quite unusual connection detail is used at the top of the hip-vertical hanger, where forgings are used instead of gusset plates, on account of the lack of space above the 14-in. pin. A detail drawing shows these forgings.

Nickel-steel eyebars are used in order to reduce the pin packing as well as to reduce the width of the bridge center to center of trusses.

In the design of the lower floor system the determining feature is the elevation of low steel established by the Kaw Valley Drainage Board, which is only 4 ft. 10½ in. below the final top of rail. This space is too small to allow using the ordinary stringer and floor beam construction: therefore, cross-beams and running girders were used as shown. While this gives a much smaller moment on the floorbeam than the other system, it is still large enough to require a heavy box beam, which was limited in depth to 2 ft. 10½ in. In order to facilitate the connection to the post, a pin has been used, engaging a casting riveted into the lower end of the post. This casting carries lugs which are connected to the top flanges of the floorbeams to transfer the stress from the bottom laterals to the bottom chord. The holes in these castings are slotted in the direction of the floorbeam to allow the floorbeams to move on their pins.

In the upper floor system two types were considered: The first with floorbeams, four track stringers and three jack stringers (one for the center and two for the sides of the deck) and the second with floorbeams, running girders and cross-beams. Complete estimates showed that the second type was much cheaper than the first, owing to omission of the jack stringers. Economical depths of girders are used. The running girders are riveted to the single-web floorbeams, which are riveted directly to the posts.

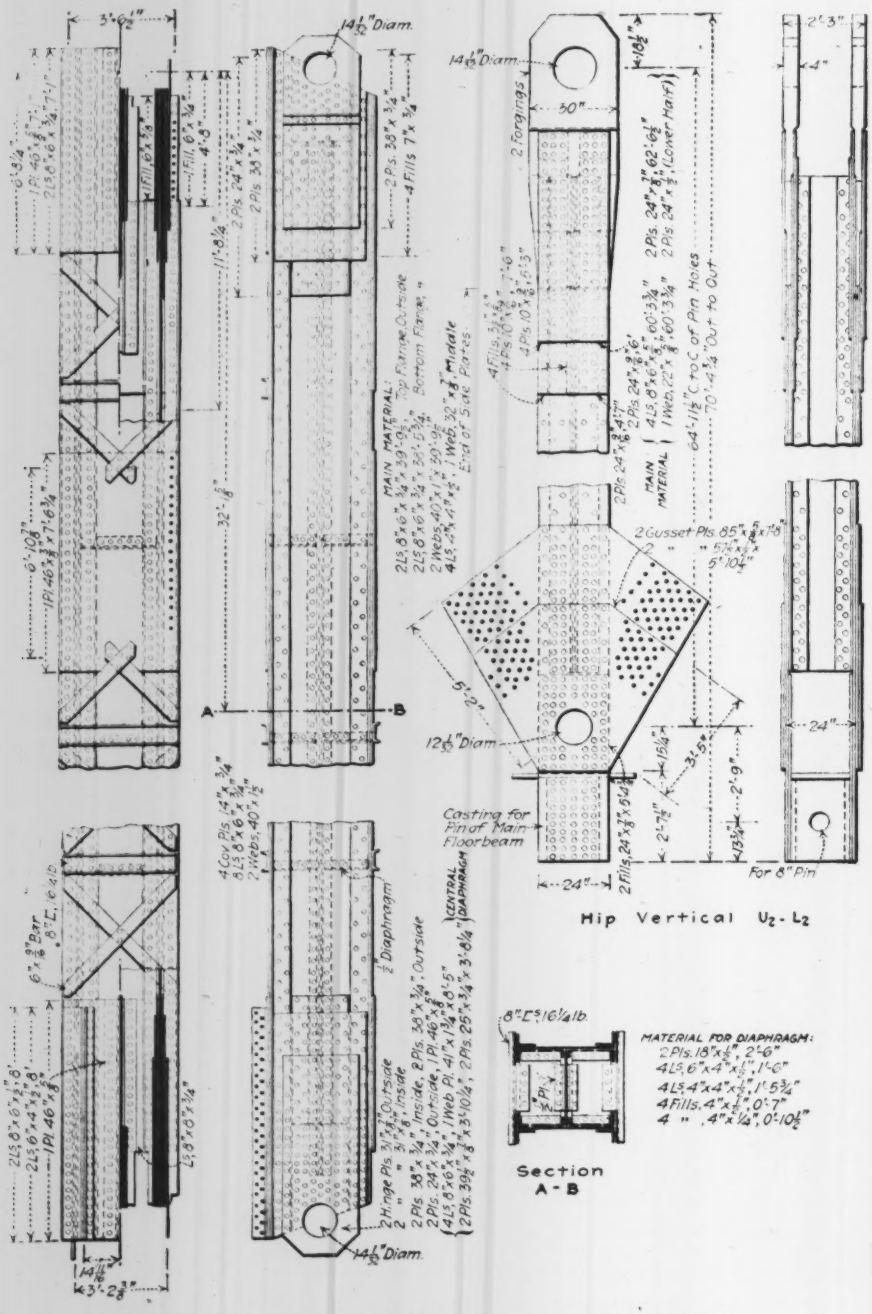
Where the end posts pass the upper floor system horizontal trusses are formed between the flanges of the floorbeam and the cross girder and are connected directly to the posts. These act as a portal to carry the wind load from the laterals and the train thrust from the deck into the posts and down to the masonry.

Secondary stresses were worked out for the 300-ft. span and it was found that the greatest increase in any stress amounted to 63.9% at the midpoint of the end post. The stress increases exceeded 30% at only few points. Material was added where necessary to prevent excessive increase of unit stress. The camber for all trusses was figured for dead-load plus half of an E80 live-load, and after the fabricated length of each piece had been figured by adding or subtracting the amount of stretch under the load the trusses were checked trigonometrically, using the fabricated lengths and the camber.

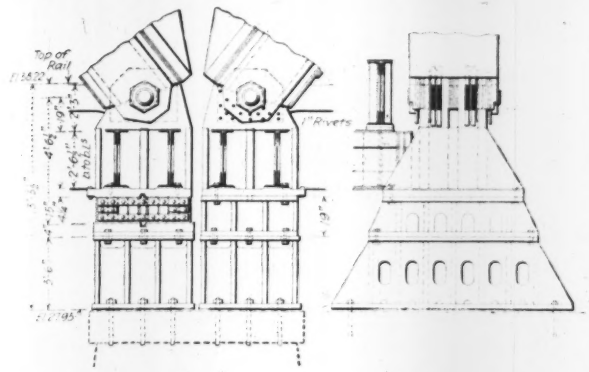
The following table gives the weights of some parts:

	Tons
Total steel	5,321
Nickel steel	540
High carbon steel	1,109
One 300-ft. truss	2,272
End post	64
Box floor beam	16
Base casting	12
One 132-ft. truss	758

On account of their light weight, wooden decks are used for carrying both the upper and lower tracks and their ballast. These decks are made up of creosoted timbers 8 in. thick which are bolted to the steelwork. All cuts and holes in these pieces are made in the



CONNECTION DETAILS OF END POST AND HIP VERTICAL

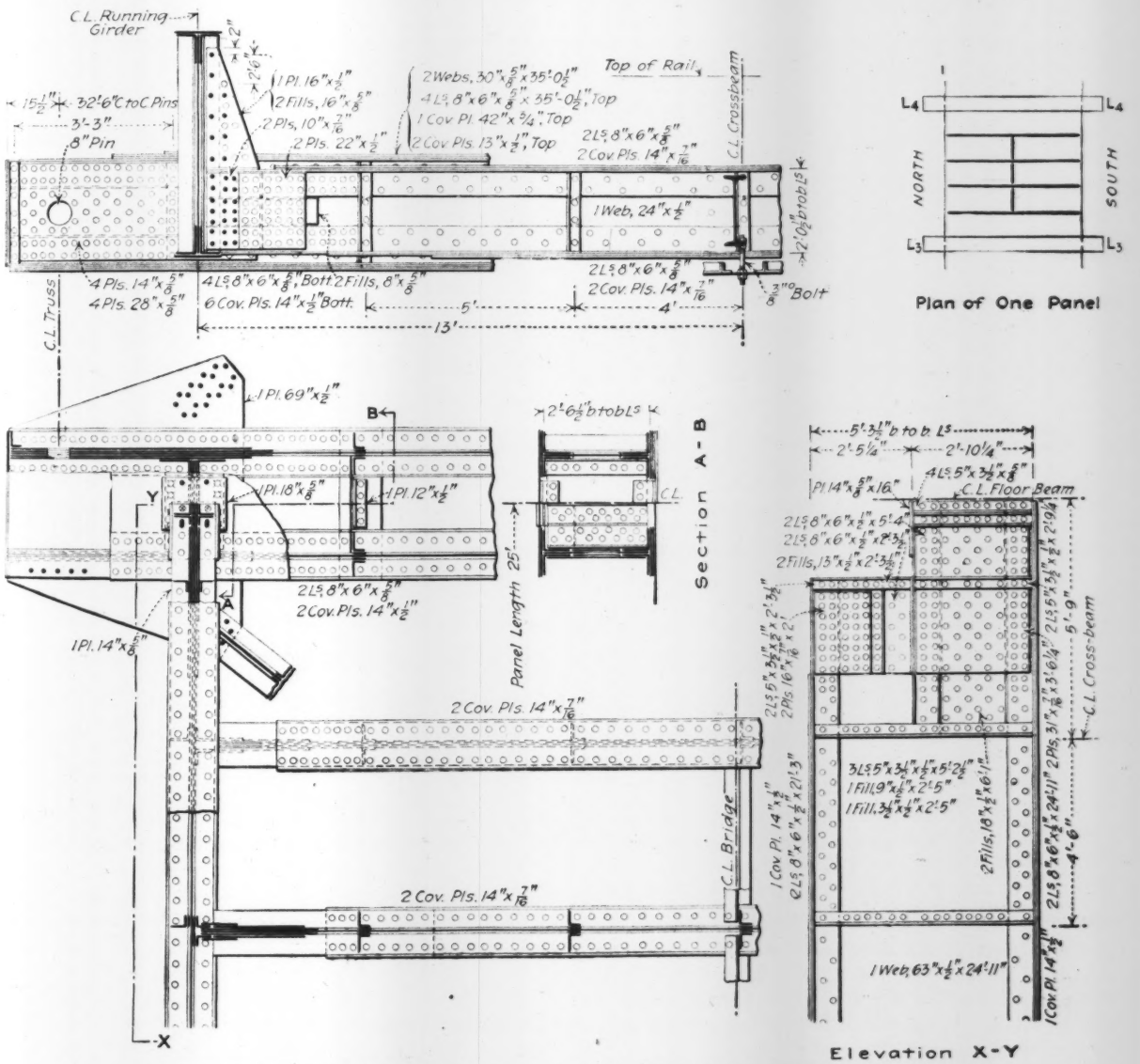


SKETCH OF FLOORBEAM SUPPORT AT SHOE

mill before creosoting so that the surfaces need not be broken during erection. The membrane type of waterproofing is used on the decks, consisting of three-ply felt and asphalt protected by a floor of 1-in. creosoted shiplap. The upper floor system is protected from the engine blast by a 3-in. concrete slab which is hung from the girders by rods.

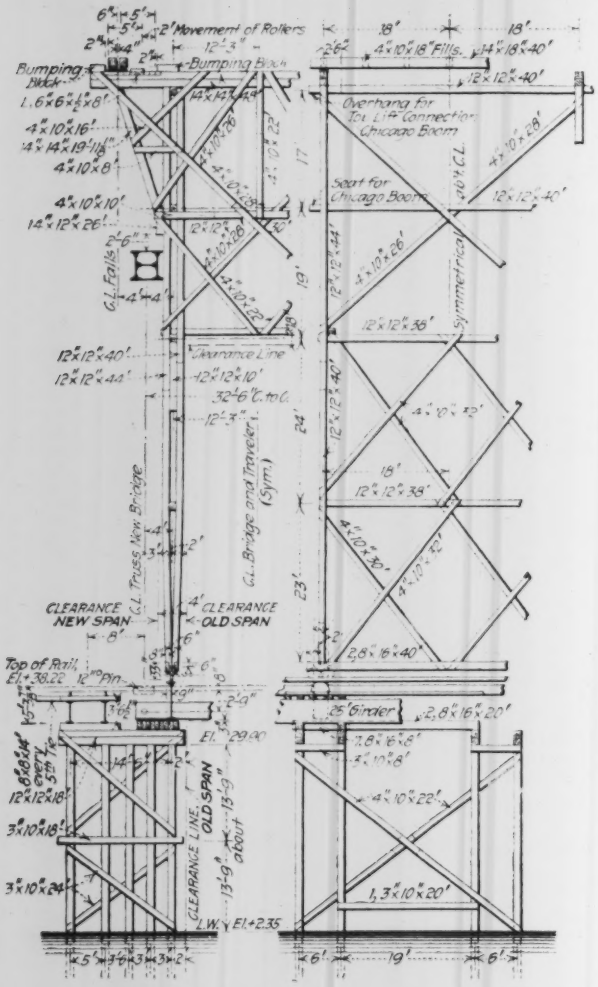
The preliminary work of erection on the bridge began in May, 1916, when the old 300-ft. spans were moved 9 ft. downstream to the center line of the new structure and raised 6 ft. 5 in. This work was done by company forces under the direction of G. E. Tebbetts, bridge engineer. Notches were cut in the piers under the shoes of the span to receive jacks; after several lifts of 8 in. each, 5-in. rollers made from shafting were inserted in the blocking and the entire bridge was jacked over the required distance. The raising was then continued to the final position. Sixteen 50-ton jacks were used and traffic was interrupted for only short intervals and never diverted. I-beams and steel plates were used for the final blocking.

When the final erection was started, Aug. 15, 1917, the



FLOOR FRAMING OF LOWER DECK WITH SHALLOW PIN-CONNECTED FLOORBEAMS

Upper deck has single-web floorbeams riveted to the posts, and running girders framed into the floorbeams



ERECTION HANDLED BY TRAVELER WORKING BETWEEN OLD AND NEW TRUSSES AND MATERIAL TRACK OUTSIDE OF STRUCTURE

first operation was to raise the old bridge another 27 in. in order to give clearance for erecting the new lower floor without disturbing traffic. Construction tracks were run out on falsework on each side of the bridge and a derrick car was operated on each track. These derrick cars placed the box floorbeams in position

CHEMICAL AND STRENGTH SPECIFICATIONS FOR STEEL.

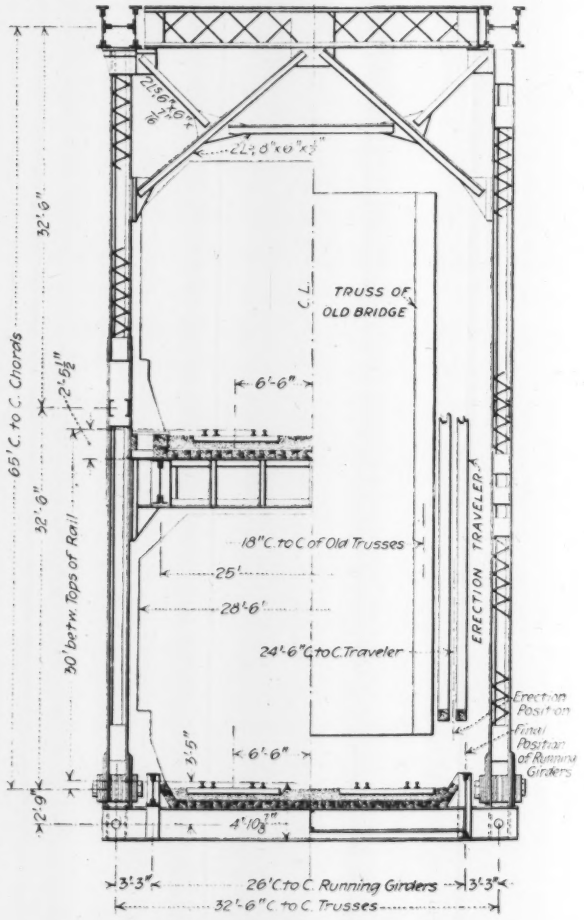
	Grade of Steel				
	Structural	High Carbon	Nickel	Rivet	Castings
Ultimate strength (Min. and max.)	55,000 65,000	66,000 76,000	95,000 110,000	45,000 55,000	65,000
Elastic limit, min.	33,000	38,000	55,000	55% of ult.	50% of ult.
Elongation in 8 in.	1,500,000 Ult. Str.	1,400,000 Ult. Str.	1,500,000 Ult. Str.	1,500,000 Ult. Str.	
Reduction of area (min.)	40%	25%	25%	50%	30%
Phosphorus, basic	0.04%	0.04%	0.04%	0.04%	0.05%
(Max.) acid	0.06%	0.06%	0.06%	0.04%	0.08%
Sulphur (max.)	0.05%	0.05%	0.05%	0.04½%	0.05%
Nickel (min.)			3.25%		

on the falsework and then set the running girders 7 in. outside of their final position. Rails were clamped to the top flanges of the girders and the traveler was built on this track, outside of the old truss and inside of the new.

The bottom chords, posts and diagonals were erected, followed by the end posts, the top chords and top laterals. The traveler then moved on to the next span and the derrick cars moved the running girders to their final positions and put in the cross-beams. After completing the trusses the traveler was dismantled.

The viaduct crane, after completing the west approach, moved on to the 132-ft. span, erecting the upper floor. On reaching the 300-ft. spans it took down the old spans and finished the upper floor. In the final operation traffic was discontinued for 24 hours and the old floor removed, leaving the new lower floor ready for use.

The Kansas River bridge was designed and detailed and the construction supervised by the Bridge Department of the Kansas City Terminal Railway Co., J. V. Hanna, Chief Engineer, G. E. Tebbetts, Bridge Engineer. The general contractor for the bridge and approaches was the Arkansas Bridge Co., of Kansas City, Mo. The steel was fabricated by the American Bridge Co. The Kelly Atkinson Construction Co., of Chicago, erected the bridge.


TRUSS OF OLD BRIDGE
ERECTION TRAVELER
65' C. to C. Chords
32'-6" C. to C. Trusses
26' C. to C. Running Girders
24'-6" C. to C. Traveler
Erection Position of Running Girders
Final Position of Running Girders

DOUBLE-DECK CONSTRUCTION GIVES 300-FT. SPAN UNUSUAL PROPORTIONS

Lumber Shipped Exceeds That Cut

For the year ending Nov. 30, 1917, the National Lumber Manufacturers' Association reports that there was 331,900,000 ft. or 2.1% more lumber shipped than cut. Of this amount the hardwood was 26,800,000 ft., but the same 2.1% rate holds.

Will Try Cost-Plus-Fee Contract with Divided Risk

THE proposed contract for the Twenty-third Street Trafficway viaduct to be built by Kansas City, Mo., from funds furnished equally by the city, the street-car company and the railway companies and stockyards, is a departure from the recognized form of contract for municipalities.

The city recently asked for bids for the construction of this viaduct on a unit-price basis. The only bid submitted contained prices which were approximately 50% above those estimated by the consulting engineer, and the proposal contained in it a clause which would compel the city to pay to the contractor any increase in the scale of wages prevailing at the time the proposal was received, which made the price to be paid the contractor dependent upon the rate paid all classes of labor after the contract was let. The bid was not accepted, and the city is now advertising for bids on two bases: unit-price, and cost-plus-fee.

Under the latter plan the contractor must name an estimated cost, which would be revised when the actual quantities were known on the completion of the work, using the unit prices mentioned in his preliminary estimate. The fee must not exceed 10% of the estimated cost. Any saving the contractor can make under the estimated cost of the work will be divided, his share being one-half. In case the cost of the work overruns the estimated cost he will pay one-half of such excess cost, but in no case shall he receive as a fee less than one-third of his original fee.

This form of contract is, of course, not unusual between corporations and contractors where the corporations reserve the right to select the list of contractors to bid upon the work, but it is unusual in the case of municipal work, and the outcome will be looked for with keen interest by engineers who are now trying to get work done by contractors and finding it difficult to do so on account of the rapid fluctuations in prices of labor and material.

Annual Rainfall of 400 Inches in Hawaii

The rainfall on the Hawaiian Islands, according to a recent bulletin of the U. S. Geological Survey, varies from a few inches to nearly 400 in. a year, and as much of the fertile area is made to produce through irrigation, the study of the water supply of the islands is a matter of great importance. It is stated that the critical period is approaching in Hawaiian agriculture, and that the time has come in the utilization of water when it becomes necessary to have all the information possible regarding its available sources. Since November, 1909, a study of the streams of Hawaii has been carried on at gaging stations maintained by the U. S. Geological Survey, in coöperation with the Territory of Hawaii, and Water-Supply Paper 430, "Surface Water Supply of Hawaii," just issued by the Geological Survey, gives the results of this study during the period from July 1, 1913, to June 30, 1915. It contains a list of the gaging stations maintained on the islands, estimates of the daily and monthly discharge of the streams, and the results of studies of rainfall at many points.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Lectures for Pioneer Engineer Regiments

Fourteen lectures on engineering subjects are being given to pioneer engineer regiments at Camp Sherman, Chillicothe, Ohio, under the auspices of the Cleveland Engineering Society. The series contains such subjects as railroads, sewers and drains, water supply, sanitation, composition and strength of iron and steel, topography, concrete, road making, bridging, telescopes and range finders, docks, heating and ventilating, timber, its strength and application. The addresses given to the regiment at Camp Sherman were in the nature of an experiment, but have proved so successful that arrangements are being perfected to give the series to pioneer troops at Camp Dix, Camp Meade and Camp Lee. Maj. Gen. W. M. Black, chief of engineers, states that the lectures serve to give the troops mental work of the best kind. Willard Beahan heads the lecture committee.

Club Suspends Bulletin During War

During the period of the war the Engineers' Club of Dayton has suspended publication of its bulletin for two reasons: First as a conservation measure, and second, because many of the addresses made will be on war subjects which do not permit of publication. Speakers feel freer to talk to engineers when there is no medium to print what should not be published.

As technical bulletins it is a fair question whether society publications should not be materially curtailed. The Western Society of Engineers is finding much use for a medium of chronicling current events. No society should allow itself to be crucified on the printing press. Too many already have, but it must be remembered that the publications are bodily evidence of society existence.

Lunch Meetings Useful at Nashville

By substituting social meetings and a more interesting kind of technical discussion for long and dry scientific papers, the Nashville Engineering Association succeeds in getting the interest of its members and of local engineers better than under old conservative methods. The association meets weekly in a social get-together meeting—three luncheon meetings and one dinner meeting each month. After the lunch or dinner a paper on some interesting engineering subject, or upon a public question in which engineers are concerned, is presented, or a committee report may be presented.

Such a committee report was the start of the big publicity campaign and educational effort made by the association (under its old name, Nashville Section of the Engineering Association of the South) to develop the advantages of Muscle Shoals as a site for the Government nitrate plant. A great amount of publicity was secured by the work of the society's committee and the elaborate report which the committee put out.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Let Us Face the Facts

Sir—I have read with much interest your editorial on p. 241, *Engineering News-Record* of Feb. 7, and also the article on p. 275 of the same issue.

I cannot commend too highly the fundamental burden of your editorial, which has its keynote in the words, "Let us face the facts." If we do that fairly, honestly, with open mind and clarified vision, we shall have a share in bringing about the inevitable readjustment that is now imminent. Whether that readjustment will be brought about smoothly and peaceably, or whether it will be accomplished only after a series of social upheavals, will depend upon a complete reunuciation or a retention of that philosophy which phrases right in terms of might. The present relations between capital and labor are the direct outcome of a practical belief in might as representing right, but we have never recognized it so clearly formulated as it is today. You say with reference to labor conditions, "There is not an absolute unity of interest; there cannot be a permanent peace." I agree with that fully when interpreted in connection with your following phrase which limits its application to "conditions that obtain today."

Ultimately, however, I believe it can be shown that there is absolute unity of interest and that there can be a permanent peace. Probably it can be brought about, as you point out, only by a succession of compromises until all concerned are, through hard experiences, led to the conclusion that after all the fundamental purpose for which one man exists in the world does not differ in any material way from the fundamental purpose underlying the existence of another. Since the laborer of today may be the capitalist of tomorrow, and the capitalist of today may be forced to work with his hands next week, it seems clear that in his essential character man does not change with his social or economic status. To me, therefore, the solution of the problem may be awaited with extreme hope, and I believe needs for its solution only a wider understanding of the elemental relations of mankind.

Hesitancy to face the facts at this time is the mark of the slacker. The facts must in their full force probably before the world war is terminated, and you are doing a good work in preparing us for a consideration of these economic problems that are fully as important in our national life as are our relations with foreign powers.

E. J. McCAUSTLAND,
Dean, School of Engineering, University of Missouri.
Columbia, Mo.

Sir—I read with a good deal of interest the editorial on p. 241 of your issue of Feb. 6, entitled "What Is Labor Unrest?"

It has seemed for a long time, both to me and to a number of engineers of my acquaintance, that it is long past the time when engineers should have begun to take an active part in the solution of the problem of industrial relationship.

I have given considerable thought to the subject for years; having become interested in it through having been mixed up in labor troubles myself when working as a building tradesman on the Pacific Coast, before I took up studies leading to engineering work. I have been at different times radically aligned on both "sides" of the question—according to what seemed to be the "rights" of the particular case before my attention at the time. But I have come to believe with you that the root of the trouble lies too deep for it to be cured by the application of any such poultice as "higher wages" or "shorter hours" or "better working conditions." Indeed, its cure cannot be reduced to any formula or voiced by any slogan whatever.

The subject is so many-sided that even the most openminded of its students are apt to forget to look all around it. They are very prone to see one thing which is wrong, shut their eyes to all else, and become one-sided faddists. With profound disgust I have read headings in the newspapers such as "Professor so-and-so says Low Wages are the Root of All Industrial Ills." And it is with an equal sense of relief that I read in a periodical so well known as *Engineering News-Record* an opinion to the effect that the real trouble lies beneath these superficial pimples. I had begun to wonder if there was any real broadmindedness left in the world.

I have believed for a long time—and have put the belief into practice wherever I have been able to do so—that the solution of these human problems is as much a part of the duties of an engineer as are solutions of more material technical problems. I do not think that this problem will yield to the same exact mathematical reasoning for which the engineer stands in the public eye, but I do believe that it is a part of his duty to attempt a solution of these troubles, so far as he is able, because he is usually the man who stands between the big employer and his employees—the parties who are arrayed against each other in troubles of this kind. The engineer more than anyone else comes into intimate contact with both parties to the controversy. He has the chance to become closely acquainted with the viewpoints of those on opposite sides of the trouble, if he will. He, as a rule comes into contact with a wide enough range of men to gain a deep knowledge of human nature. And, finally, the whole mental training of an engineer tends to openminded investigation and judgment.

It has been very often his shortcoming—due largely, perhaps, to defects in his training—that he has confined the exercise of his powers to the more material matters relating to his work. There are, however, many shining exceptions to this rule. And if the profession as a whole is to come into its own, there must be many more exceptions.

Consequently, I believe it cannot be too strongly urged upon engineers that their duty and their opportunity lie in the direction of applying themselves to the solution of this great question of today as well as of purely mechanical problems. And I am more than glad to see *Engineering News-Record* take up the cudgel with the object of interesting engineers in industrial difficulties.

We all need to have it pounded into us what a few of us are but beginning to realize: That the whole structure of organized society is resting on very thin ice; that the ice is becoming thinner daily, melted by the fire of distrust. Unless we awake and take active steps to quench this distrust, some day, not far distant, we shall face chaos.

I would not be human if I did not want to offer a few suggestions as to what I believe ought to be done to help matters. But there are many abler brains than mine on the job, so I will refrain. But I will say, that if you believe it would be a good thing to form an organization of engineers for the purpose of awakening the profession at large to the need of action in this matter, for disseminating information about it, studying it, or for anything else relating to it that needs to be done, I will gladly give my spare time to that end.

Meanwhile, I want to congratulate you on your advanced stand toward the problem, and am awaiting with interest your further editorials on it.

LEO G. HALL,
Assistant Engineer, with Westinghouse Church Kerr & Co.
New York City.

Sir—Congratulations! Your editorial of Feb. 7 anent the labor situation is the best yet.

Don't let the subject drop. Follow it up with another and yet another along the line started. Drive the nail a little further home every time. Clinch it before it works loose and drops out.

Tell us how the successive compromises and readjustments between contending factors approach a condition of social equilibrium. Tell us why the condition of equilibrium is the best that can obtain, because a maximum of collective satisfaction is reached and the incentive to depart therefrom reduces to zero.

Tell us that the criterion for this condition of equilibrium is that each individual is to be compensated according to his efficiency in promoting that equilibrium. Tell us how this efficiency can be measured.

Tell us about the mutuality of interests existing among all individuals; that no one man produces all the varieties of wealth that he seeks to use or consume; that hence he must exchange portions of his output for portions of different outputs of other individuals; that the larger the outputs of these other individuals the more he can receive in exchange for a unit of his own; that the larger his own output, the more the other individuals can receive in return; that this mutuality of interests in its final development leads to a maximum output; that therefore the individual can attain his maximum satisfaction only when all other individuals secure theirs.

Tell us that the use and consumption of wealth is essential to human satisfaction; that before wealth can be used or consumed it must be produced.

Tell us how the output is due to four main factors—the land factor, the labor factor, the capital factor and the administration factor. Tell us how the four factors may be combined in one person or in one group of persons, or how they may be distributed among many persons or groups; and that without these factors acting jointly, production cannot take place; that without production we cannot satisfy our wants; that without the fundamental satisfactions we cannot live, society cannot exist and dissolution takes the place of evolution. Therefore recognition of our mutuality of interests is imperative. A maximum production is imperative. A distribution of the output in proportion to efficiency is imperative. Equilibrium is imperative.

We may help or retard the equilibration process, but in the end equilibrium will obtain. The culmination of all our readjustments and compromises eventually leads to equilibrium. It cannot be avoided. It must be accepted as one of the inexorable laws of nature.

R. C. BARNETT,
Kansas City, Mo. Consulting Civil Engineer.

Compensation for Railway Engineers

Sir—I have read with much interest the many articles that have appeared in your columns relative to the status of the engineer. Perhaps the following facts may be of sufficient interest for you to publish. In a certain division engineer's office of one of the leading railroads of the country, while data were being compiled for the use of the Railroad Wage Commission now in session at Washington, a discussion arose as to the relative value of the services of a transitman and a foreman carpenter or a foreman painter as employed in the maintenance-of-way department of this railroad.

The duties of the foreman carpenter or of the foreman painter are of course generally known, but for the benefit of readers who may not be familiar with the duties performed by a transitman, I will mention some of the work that a transitman in the above department has performed during the past three or four years: designed many concrete abutments and piers up to 600 cu.yd., small dam to impound water for pumping head, fireproof buildings with reinforced-concrete roofs, special pumping intake with settling chambers, screen-gate control; had charge of harbor soundings, inspection of 500-ft. pier by diver, dredging of harbor entailing an expenditure of about $300 per day, all kinds of plane surveying, both city and country work, obtaining data for and designing curbs and pavements and brick and concrete platforms; made architectural plans for remodeling and new construction, design of hot water and steam heating plants, alignment and grades for tracks, estimates; obtained information and reported upon the stability of bridges under surveillance, etc.

Readers of *Engineering News-Record*, know the class of buildings in use by the railroads and how much skill, artistic ability and other qualifications are demanded, say, of the foreman painter, yet this certain engineer who had charge of compiling the data referred to in the second paragraph, and who was requested to make recommendations to the wage commission, reasoned and I believe recommended that the painter foremen, carpenter foremen, etc., should continue to receive several dollars per month more than the above transitman.

The questions are: "What is the matter with a college education?" and "Do engineers promote their own profession?"

I would not have it appear that I am criticising in any way the above mentioned division engineer. He

has a right to his personal opinions. But I desire to learn, as undoubtedly many others would, the attitude of other engineers in similar positions regarding the status of the young engineer. FRED E. LADD.

Watertown, N. Y.

[With regard to the questions raised, the efforts of the Engineering Council, described on page 452, may be referred to.—Editor.]

Column Tests Need Full Analysis and Thorough Discussion

Sir—Permit me to extend my congratulations upon your keen editorial analysis of the report of the American Society of Civil Engineers on its investigation of steel columns. It is worth while to repeat and to emphasize the following sentences from your editorial:

"Engineers of wide information, interviewed on this matter, have not recalled accidents of the kind suggested. Is the committee's statement intended to conjure visions of the Quebec chord, of the Panama crane strut, and of similarly flimsily assembled open-section members? If so, the plain answer must be made that they have nothing to do with the case. . . . . The recommended stress is not so much a deduction from test results as it is a reflection of the committee's judgment."

When the mind is too intently concentrated upon the beautiful precision and completeness of the investigation, it seems natural to pass lightly over the logic of the deductions. For this reason, free discussion is of prime importance. A. J. HIMES,

Valuation Engineer, New York, Chicago & St. Louis R.R.

Cleveland.

Sir—Your editorial in the issue of Feb. 7 accompanying an abstract of the final report of the committee on steel columns and struts of the American Society of Civil Engineers deserves the earnest attention of all structural engineers. I desire to emphasize particularly the point that the profession is under a most profound obligation to see that the results of this expensive series of tests are properly analyzed. Although you rather lavish praise on the work of the committee, I cannot find in their report any convincing evidence of exhaustive study having been given to this mass of data resulting from the most extended series of column tests ever attempted.

It is questionable whether the allowable unit stresses recommended by this committee will be adopted, or even given serious consideration by the profession. This will be due principally to the fact that no convincing reasons are advanced for the adoption of the proposed unit stresses. The new term "useful limit point" is nothing but a special yield-point based upon Johnson's well-known method, and the selection of a mean between the general average and the lowest result is certainly arbitrary, to say the least. More questionable still, however, is the proposed value of 8000 for the alowable unit stress at l/r of 120. The committee apparently has no definite reason to offer for the selection of this figure; if so, the profession would be interested to know it.

More astonishing still is the fact that the greatest discovery resulting from these tests, namely, that thickness of metal profoundly affects column strength, has no place whatever in the recommendations made by the committee.

I must question your editorial conclusion that nearly every kind of construction will become more costly if general practice adopts the committee's proposed values. I believe you must be in error in ascribing to the committee a determination to lower the allowable unit stresses because of accidents due to column failures. Inspection of Fig. 3 on page 252 of your issue of Feb. 7 indicates that the selection of 8000 l/r of 120, together with the extension of the base value of 12,000 to a limit for l/r of 80, both of which are apparently arbitrary choices not explained by the committee, result in a field where the allowable stress is higher than the A. R. E. A. formula prescribes. It is just in this field that a large proportion of the columns used in practice will lie. Since the A. R. E. A. values are now almost universally accepted in standard practice, I do not follow your reasoning when you imply that the committee has deliberately reduced allowable unit stresses and thus increased the cost of structural steel construction.

Finally, I repeat my conviction that these expensive column test results have not been adequately studied and compared. I suggest that the American Society of Civil Engineers should fulfil its obligation to the profession and to the Government by engaging a thoroughly competent engineer to devote his whole time to an analysis of the most thorough character into this mass of experimental data, with the object of presenting a recommendation which, by its intrinsic worth, would convince the profession and all practicing engineers that his resulting conclusions and allowable stresses then recommended should be adopted forthwith.

J. P. J. WILLIAMS,

First Assistant Engineer, Concrete Steel Engineering Co.

New York City.

[Comparison of the committee's proposed stresses with those of the American Railway Engineering Association column formula must take account of the fundamental differences between the two. The A. R. E. A. formula applies to bridge members subject to the practical variations of construction and loading, and exposed to live-load stress; it does not involve any restriction as to end conditions or as to uniformity of bearing. The committee's proposals, on the other hand, are specifically limited to square-end columns carefully fitted so as to have perfect bearing, and exposed to static load only. Thus the two do not refer to the same conditions or actions. Square-end columns are almost nonexistent in practice, and the necessary modification of the committee's proposals for application to design would probably change either the load figures or the limits assigned to them. Reduction to the usual pin-end basis, for example, would shorten the horizontal line of the committee's curve possibly one-half, even if the 12,000-lb. value were retained.

For columns used in buildings, where the loading is essentially static, higher stresses than those of the A. R. E. A. formula are allowed. Comparison of the

committee's proposals with present design practice must take this into account.

Mr. Himes' and Mr. Williams' demand for full study of the column tests and exhaustive discussion of the results becomes even more forcible as the many complicating features of the subject are contemplated.—Editor.]

Sir—Regarding the editorial "Do We Need Safer Columns?" in *Engineering News-Record* of Feb. 7, may I offer a few remarks?

To the writer it seems hardly a question of whether or not we "need" safer columns, but rather "Can we find a better way than the present of determining safe sizes for our compression members?"

The assumption seems to have been made that all columns designed by the A. S. C. E. Committee formula ($20{,}000 - 100l/r$ with a limit of 12,000) would be heavier than those designed by the A. R. E. formula ($16{,}000 - 70l/r$ with a limit of 14,000). The fact is that a great number of columns, falling between 57 and 132 radii in length, would require less material under the new formula. It may be remarked that many engineers for years have used 12,000 as the maximum stress for compression members; 12,500 reduced by Gordon's formula has also been extensively used, and this requires greater areas than the A. S. C. E. formula for lengths of 40 to 1000 radii approximately. For lengths up to 120 radii, the American Bridge Co.'s formula $19{,}000 - 100l/r$ is comparable with the new formula, but this requires larger sections for lengths over 70 radii, and on the other hand allows a limit of 1300 lb. for lengths of less than 60 radii.

It would seem, therefore, that for a large proportion of columns the new formula wil give greater economy and efficiency if we accept the recommendations of the A. S. C. E. Committee, long and careful deliberation having led to their conclusions. A. W. A. EDEN.

New York City.

[Comment on comparison between the committee's recommendations and practical column formulas now in use is appended to Mr. Williams' letter. Mr. Eden's statement of the problem as "Can we find a better way than the present of determining safe sizes for our comparison members?" expresses an essential view of the subject.—Editor.]

Ford Combination Promises Street Sprinkling Economy

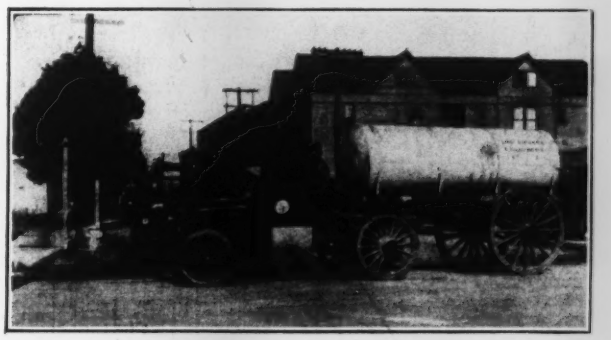
Sir—By attaching a Ford car to the front axle of a street sprinkling wagon, as shown by the accompanying view, the city of Los Angeles, Calif., is watering its streets at an operating cost less than that of horse-drawn equipment in this neighborhood. It is believed that the combination may prove to be more economical than large sprinklers mounted on rubber-tired trucks.

The rear axle of the Ford is set forward and attached to the frame, where, with sprockets substituted for the wheels, it serves as a countershaft for driving the front wheels of the wagon by means of chains. It was found on trial that the chain-drive sprockets required nearly a 4 to 1 speed-reduction ratio to get the best results.

The rear springs of the Ford were shortened (some of the spring leaves being removed) and mounted on the front axle of the wagon with attachments which pivot vertically so that any pair of wheels can freely rise above or drop below the plane of the other wheels, the vehicle thereby accommodating itself to undulations in the roadway. Adjustable radius rods were also provided to connect the front axle of the wagon to the rear axle of the Ford.

The alterations to the sprinkling wagon consisted of removing the tongue and attaching sprockets to the front wheels by U-bolts which pass around the spokes.

The tank has an air chamber. It is filled by forcing 500 gal. of water into it from a hydrant under city pressure. This compresses the air in the chamber and



FORD CAR DRAWS STREET SPRINKLER AT LOS ANGELES

furnishes energy for expelling the water while sprinkling.

The vehicle sprinkles the full width of a street at one operation. It operates satisfactorily at 7 miles per hour. Its present average performance with a skillful driver is 9½ miles of street sprinkled and 21,000 gal. of water spread per 8-hour day. The estimated operating cost is 64c. per mile of street sprinkled, no data being yet available as to cost of mechanical repairs.

R. W. STEWART,

Engineer Bridges and Structures, City of Los Angeles.

Las Angeles, Calif.

Mexican Society Celebrates Its Fiftieth Anniversary

Sir—The note on the recent centenary of the Institution of Civil Engineers in *Engineering News-Record*, Feb. 14, 1918, p. 292, suggests a record of the fact that the half-centenary of the Society of Civil Engineers and Architects of Mexico was celebrated Jan. 24, 1918, in the Hall of the Fine Arts Academy, City of Mexico, where the society was founded. In commemoration of the foundation an engraved program was issued, the front page showing conventional female figures, together with locomotive, dynamo, transit, drawing instruments, and a distant view of the grand cathedral of the city.

The anniversary committee was composed of Agustin Aragon and Lorenzo Perez Castro, both engineers, and Nicolas Mariscal, an architect. The exercises comprised several musical selections, including Monasterio's "Invocation to Science"; a reading of the minutes of the meeting of Jan. 24, 1868; an address to the founders and members of the society by Jose Luis Cuevas, an architect, the representative of the younger membership.

Buffalo, N. Y. EMILE LOW.

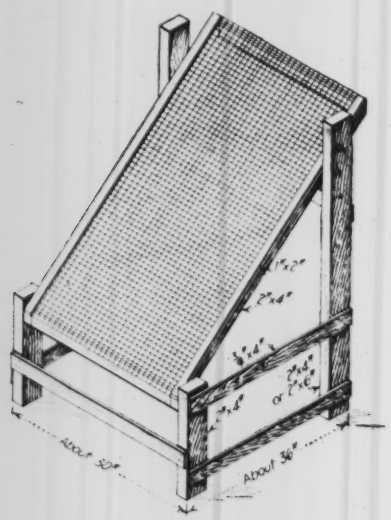
HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Screens and Loads Gravel to Wheelbarrows in One Operation

By Harold J. Spelman
LeRoy, N. Y.

A VERY simple and inexpensive method of screening gravel, for use in concrete foundation under brick or block pavement, into fine and coarse aggregate, has been used to advantage by a contractor in western New York. As the accompanying sketch shows, it consists of the use of a slanting hand screen which can be raised or lowered a few notches as the character of the material



SCREENS AND LOADS IN ONE OPERATION

requires, and which will usually gives best results at an angle of about 45 deg. The gravel is thrown by the shoveler against the screen, the sand falling through into one wheelbarrow placed underneath, the stone rolling down the screen into another wheelbarrow placed in front of it. Two sizes of wire mesh can be kept on the job. When the gravel is dry a ¼-in. mesh will give good results, but when the gravel is wet a ½-in. will be better. The wire mesh can be easily changed or replaced.

The use of a unmber of these screening frames has been found especially of value where conditions make it desirable to have pit-run gravel delivered on the work by subcontract, or where the number, character or location of the gravel pits makes it impractical to set up a screening outfit. An additional advantage lies in the fact that the material is screened and loaded on the wheelbarrow for the mixer at one handling.

The excess sand, when there is any, can be thrown to one side for use in the cushion, grouting and cover, or the screen can be set on the curb so that the sand will fall back of the curb or on the shoulder, the stone falling into the wheelbarrow in front.

Wire Coil Prevents Brooming of Piles

IN DRIVING foundation piling on small jobs, where a driving cap or follower is not available, pile bands may be dispensed with by the use of a spiral coil of No. 9 wire on the top of the pile, to prevent brooming of the head. The coils are made on a conical block, like the point of a pile, spiked to the side of an upright timber. About six or eight turns are made from the base to the point of the cone. The coils are made in advance, and when a pile is ready to be driven one of these conical caps is placed on the top, flattened down and secured with staples or nails. The first blow of the hammer sinks the wire into the fiber of the wood so that it forms a spiral reinforcement that will prevent brooming or splitting of the pile under the hammer blows. The wire costs very little. Less than 3 min. per pile is required to make and apply the spiral cap.

The method was devised by E. Welden, of the Welden Construction Co., Iowa Falls, Iowa, and has given successful results.

Wood Cushion Built Up in Layers Used in Driving Concrete Piles Through Clay

By Carl C. Halloway
Superintendent of Construction, U. S. Public Buildings, Portland, Ore.

WITH reference to the use of wood cushion blocks in driving concrete piles at one of the navy yards, described in *Engineering News-Record* of Jan. 24, p. 186, the writer would like to give his opinion that the shape and construction of the pile head is of equal importance with the type of cushion, which latter should depend on the character of the driving. This opinion is based on experience in driving 900 large precast concrete piles for the foundation for the new postoffice building at Portland, Ore., through exceedingly tough material, with heavy single-action steam hammers. The most successful cushion blocks were made by building up layers of 1-in. spruce boards nailed together veener fashion, with the grain of each layer crossing at right angles that of the one below.

Approximately 900 piles, averaging 35 ft. in length, were driven. Of these, 850 were 18 x 18 in., and the remaining 50 were 12 x 12 in. The soil through which they were driven was a sandy, tough clay. It was generally of a very "rubbery" nature, being in some places a typical gumbo, which for a penetration of 6 to 10 ft. gave a rebound to every blow of the hammer. Two water jets under high pressure were used with each driver, but on account of the tough character of the soil the jets would cut only a small hole, and for nearly the entire distance the pile had to be driven hard. Two No. 1 single-acting Warrington steam hammers with 42-in. stroke and 5000-lb. rams were used at a speed of about 55 strokes per min. From 450 to

500 blows were struck on each pile. The maximum number of blows used in driving any one exceeded 1000. In several instances the hammering was so hard that it burned a hardwood driving block to a depth of 10 inches.

In experimenting it was discovered that several conditions entered into the successful driving of these piles besides the cushioning of the pile head. The first that were driven were cast with square heads, with the top ends of the reinforcing steel 3 in. below the top of the pile.

A 2-in. rope was coiled under the driving block for a cushion, but in each case the pile head was shattered long before satisfactory penetration was obtained. Then a wood cushion built of six layers of 1-in. spruce was tried, but also proved a failure. Next, the head of the pile was cut down to within 1 in. of the top of the reinforcing steel and trimmed to an oval shape, giving bearing surface only about 6 x 6 in. in the center portion.

After this change was made, the rope cushion was tried again with but litle more success than at first. The wood cushion built up of boards was then resorted to, and used successfully for driving the remainder of the 900 piles.

Of course, these wood cushions had to be renewed often, but one would generally stand from 75 to 100 blows before it became useless. With the piles shaped to give bearing only on the center portion, the steel in close proximity to the top, and with the use of these wood cushions, the injury done to the piles was slight. Generally, when an injury occurred it was directly traceable to carelessness on the part of the crew operating the driver. The 18 x 18-in. piles averaged ½ in. penetration to the last ten blows of the hammer, while the 12 x 12-in. piles averaged 1½ in. to the last ten blows. The points of the piles in all cases penetrated from 6 to 18 in. into cemented gravel. A large number were driven to absolute refusal.

In the experience with rope cushions on this work, the rope became solid under intense hammering, until it was really like a piece of iron and gave no cushioning effect at all. In the writer's opinion, the soil conditions of the individual job have more to do with determining the method of cushioning and driving precast piles than anything else, and where wood cushions were entirely successful in this case, in some other cases they might fail.

It is safe to conclude, however, that in any soil conditions a pile head cast with small bearing surface at the top, to prevent the blow from striking the edges of the top, with reinforcing steel brought close to the surface, and with the lateral members closed in to give greater binding, will withstand much greater punishment than otherwise.

Six of the 18 x 18-in. piles driven at the Portland postoffice were tested with 60 tons apiece, the greatest settlement being 0.018 ft. Another 18 x 18-in. pile was tested with a load of 81 tons, which remained on the pile for 15 days and was kept in a constant state of vibration, the settlement at the end of the period being the same as that for the other 6 piles. These piles are designed to carry a load of 45 tons apiece in the finished structure.

Special Belt Conveyor Backfiller Speeds Sewer Construction

By R. E. Juergens
Weller Mfg. Co., Chicago

This backfiller was specially designed by Byrne Bros. Construction Co., of Chicago, in conjunction with L. A. Dolton, one of the engineers of the Weller Mfg. Co., of Chicago, for building a 17-ft. concrete sewer. Progress of 30 to 35 ft. a day was made. An initial cut to

CONVEYOR BELT USED FOR BACKFILLING WAS CARRIED ON RAILROAD LORRY CARS

net section was made by a revolving steam shovel, which loaded the spoil to industrial cars, conveying to a dump. Following this came a dragline excavator which dumped the material into the 10 x 12-ft. hopper of the backfiller.

A system of heavy rotary knives beneath this hopper reduced the larger chunks of material to small size for conveying. A heavy belt conveyor carried on sills supported on light railroad lorry cars moved the material back to a lateral conveyor with outrigger belt which covered the full width of the excavation.

Deval Cylinder Modified for Slag and Gravel

The Highway Commission of the State of New York has been testing slags and gravels for the purpose of determining their availability for use in various pavement types. The tests on these two kinds of material made in the standard Deval abrading machine were not truly indicative of quality, nor were the results comparable between different qualities of stone, according to H. E. Breed, first deputy highway commissioner. Experience demonstrated that the material worn from the sample during the period of the test filled the corners of the cylinder and, forming a cushion, greatly reduced the amount of abrasion. Experiments indicated that when the cylinder was slotted at intervals in such a way as to allow the detritus to escape, and thus avoid its cushioning effects, the results were more valuable. Steel shot had been employed in testing gravels, in the Deval cylinder, but, judging from results so far obtained, the more satisfactory method is to dispense with steel shot, but to use the slotted cylinder.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Dam at Muscle Shoals, Alabama, Will Be Built

President Authorizes Huge Hydro-Electric Project on Tennessee River as Part of New Government Nitrate Plant

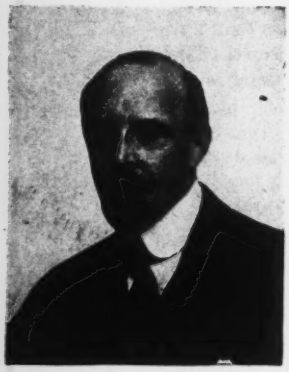
On Feb. 25 President Wilson signed an order authorizing the construction of the largest of the dams on the Tennessee River projected some years ago for the Muscle Shoals hydro-electric development. The construction is to be carried out with funds derived from the appropriation for a government nitrate plant, which became law in 1916, and the hydro-electric plant when completed will become a part of the two nitrate plants now being built near Muscle Shoals at Sheffield, Ala. These two plants are: (1) a factory for the fixation of nitrogen which will produce approximately 20,000 tons of ammonium nitrate a year and will be owned and operated by the United States and (2) a plant owned by the United States but operated by the Air Nitrates Corporation, which will produce 110,000 tons of ammonium nitrate a year. Electricity used in the operation of these plants will be generated by steam power and will be brought from distant hydro-electric plants for initial operation, but will eventually be produced at Muscle Shoals.

Reports on the Project

The Muscle Shoals development has been the subject of exhaustive investigation by the United States Corps of Engineers and the present construction will form a part of a project made by Maj. Harry Burgess, Corps of Engineers, and approved by his various superiors in the Corps of Engineers. This report, first made in 1913 and later amplified, may be found in detail in documents of the House of Representatives as follows: 63d Cong., 2d sess., Doc. No. 20; 64th Cong., 1st sess., Doc. No. 981. The whole project involves the improvement of a long stretch of the Tennessee River for navigation as well as the development of power, but the present proposed construction will be confined to what is known in the report as Dam No. 2, with its appurtenant locks and immediate river improvement. It forms, however, a completed part of the entire river development, which can be continued as the exigencies of the money situation and other necessities demand.

Lock and Dam No. 2 are located at Sheffield, Ala., and comprise a gravity concrete dam 68.5 ft. high above bedrock and of 3300 ft. spillway length. There will be two locks, each 60 x 288 ft., with a total lift of 58.5 ft., designed for a 6-ft. navigation depth. At the dam a high-water head of 45.5 ft. and a low-water head of 64.5 ft. will generate 100,000 hp. In the 1913 report the estimated cost of the lock and dam project with the necessary appurtenances is about $10,000,000 but the present high prices will bring the cost today far beyond the figure quoted at that time.

J. P. Channing, Elected First Chairman of the Engineering Council



J. PARKE CHANNING

[Notice of Mr. Channing's election was published in last week's Engineering News-Record.]

J. Parke Channing, elected chairman of the Engineering Council at the first annual meeting held Feb. 21, was born in New York City and was graduated from Columbia University with the degree of engineer of mines and master of science. Since his graduation he has been engaged in mining in Lake Superior iron and copper mines at first, and afterward in Montana, Utah and Tennessee, more particularly in copper. In 1900 he developed and equipped the Tennessee Copper Company and a few years later built one of the largest sulphuric-acid plants in the world to ultilize the waste gases from its copper furnaces. In 1907 he discovered and developed the Miami copper mine in Arizona, now producing copper at the rate of 60,000,000 lb. per annum. For three years he was president of the Mining and Metallurgical Society of America and is now its vice-president, and for two years he was a vice-president of the American Institute of Mining Engineers.

Mr. Channing is vice-president of the Miami Copper Co. and the General Development Company.

News-Record's Correspondent Gets Taste of Real War

Robert K. Tomlin, Jr., correspondent of *Engineering News-Record* in France, has been under fire from two enemies at the same time. One foe was illness, which kept him in bed in an upper story of a Paris house, while another enemy, German aviators, bombarded the French capital. Mr. Tomlin tells the story in the following extract from a recent letter:

"I am gradually coming back to life after two weeks of very serious illness—flat on my back in bed all the time and with a doctor who didn't seem to be able to do very much to help me, except to say that it was nothing very much to worry about and would just have to run its course. This, as you may imagine, was small consolation to me, and it was maddening to have to lie helpless in my room day after day, when so many important things are waiting for me to do. I am out of bed and downstairs today, but my underpinning is so weak that I can't walk more than a few blocks without stopping to rest. But my strength is gradually coming back and I hope to be myself again in another week.

"Then, to add zest to the occasion, we had a big German air raid the night when I was feeling worst and, as my room is on the next to the top floor, it was far from comforting to be stretched out in bed helpless and hear the hum of the airplanes, high up above the city, the steady booming of the anti-aircraft guns, and, most harrowing of all, the crash of the explosive bombs which the Hun airmen were dropping all over town. This little episode has brought the war closer to me than anything I have yet been up against. The damage about town was considerable, although the papers here were not allowed to say much about it. The deaths officially reported were more than 50. How many more there were that never got into print the authorities only know. Still, it's all in the day's work."

French Waterworks and Roads Interest American Engineers

"Every soldier over here from the United States will go back an enthusiastic good roads advocate," writes Capt. Paul Hansen, former chief engineer, Illinois State Board of Health, from general headquarters in France. He is in the water-supply service with Lt. Col. F. F. Longley, formerly with Hazen, Whipple & Fuller. Parts of his letter follow:

"The roads are marvelous and the country wonderfully beautiful and picturesque.

"The French road system is a revelation even in time of war, not so much in the matter of construction, because we can and do build macadam roads as good and better, but principally in the matter of upkeep, for which the French have a positive genius. Roads are divided into sections like our railroads, with little section gangs who keep their tools in neat little stone section tool houses. As soon as a bad spot develops on a road it is repaired and when the spots become so numerous that they cannot be repaired at once, an entire new layer of broken stone and binder is put down. The problem is simplified very much by the fact that suitable road metal can be found anywhere a few inches below the surface. A most striking and beautiful, as well as practical and useful feature of French roads is the presence of shade trees on either side. These shade the road in summer, mark the road in winter when covered with snow and add very materially to the forest resources of the country, as is evidenced just at this time. I am told that oiling of roads is not practiced because it tends to injure these trees. In dry times the roads are somewhat dusty, but the dustiness is considerably reduced by the shade of the trees. Another striking feature of French roads is the great care observed in promptly removing all surface water. On each side of the road at intervals of about 50 ft. little waterways are kept clear leading into grass lined side ditches outside of the tree line.

Roman Water-Works Still in Use

"Even the little villages of a few hundred population have for the most part a public water supply, but in principle these water supplies differ very little from the old Roman supplies. The main difference is that pipe instead of gravity conduits is used. House connections in towns with less than a thousand population are very unusual. In one little town of about 500 population I actually found a water supply installed by the Romans still in use.

"Water is generally obtained in limited quantities from a spring at sufficient elevation to permit a gravity flow to the town. Main piping for conveying water to the town and through the streets is often as small as 2 in., usually of cast iron, sometimes of wood. There may be from one to ten outlets in town, depending on the size of the town and the volume of the supply. These outlets vary from single street hydrants to highly elaborate and ornamental structures. The most usual arrangement is a constantly flowing stream issuing from a bronze ornament such as a lion's head or a swan's bill conveniently arranged for drawing pails of water. Water not caught in pails falls in troughs at which animals are watered. These animal watering places have forms varying from single cast-iron or stone troughs to elaborately ornamented circular basins. The overflow from the animal drinking places flows into the public laundering place

(Concluded on page 482)

Concrete Offices with Forty-Two Acres of Floor To Be Built in Washington

Fireproof Structures To Be Completed in Five Months at Cost Little Greater than for Earlier Temporary Buildings

(Washington Correspondence)

One of the largest office buildings in the world, if not the largest, and certainly the largest concrete building, is to be built at Washington in the next six months. Ground was broken for it on Feb. 25; it is to be turned over for occupancy complete within five months from the date of approval of the foundation plans, which will probably take place about Mar. 10. It will cover most of the area of a site 1800 ft. long and 560 ft. deep and will be three stories high. Most important of all, it will be of reinforced concrete throughout, a radical departure from the other temporary office buildings that the war congestion has forced the Government to build at Washington.

For War and Navy Departments

This new building, or rather group of two buildings—for it will be in two parts, separated by a 100-ft. aisle, though the two are considered as one operation—will house most of the offices of the War and Navy Departments. These two departments long ago overran the old State, War and Navy Building and are distributed through hotels, apartments, office buildings and new temporary structures throughout the city. More space had to be provided, and provided at the earliest possible moment. The authorities considered the erection of more of the wood-frame and stucco buildings, similar to those described in *Engineering News-Record* of Feb. 21, but the danger of destruction by fire of the priceless records of the departments led to the study of the possibility of the construction of a fire-resistive structure in the short time available. For this purpose, Civil Engineer A. L. Parsons, assistant chief of the Bureau of Yards and Docks of the Navy Department, made tentative plans for a reinforced-concrete building which he found he could build for approximately $2.50 a square foot of floor area, as against $2.35 for the partly sprinklered wood and stucco buildings hitherto built for emergency construction at Washington.

Commander Parsons' plans so impressed the House Committee on Appropriations that it included in the current urgent deficiency bill an appropriation of $5,750,000 for the two buildings for the War and Navy Departments, to be erected as one group under the direction of the Navy Department. The bill has passed the House and will probably pass the Senate in the near future. Meanwhile, the department has gone ahead with the plans, has let the contract for construction on a cost-plus-fixed-sum basis to the Turner Construction Co., New York, and, as stated earlier in this note, has started construction.

The building will be located on that section of the Mall lying south of B St. North and between 17th and 21st Sts. West, just south of the new temporary buildings for the Council of National Defense and the Food Administration and some distance east of the Lincoln Memorial. This is vacant ground, partly formed some 20 years ago by fill from the river, and not covered with trees. Very little preparation of the site has to be made. The wing for the Navy will have a headhouse, as it were, 60 ft. wide and 860 ft. long, with nine wings projecting in the rear each 60 x 500 ft. and separated by 40-ft. courts. The War Department's section will be separated from the Navy's by a 100-ft. court, will have a headhouse 60 x 784 ft. and will have eight wings similar to those in the other unit. The building will be three stories high, with no basement, the first floor being at ground level. The total floor area will be 1,800,000 sq.ft.

Every effort has been made to make the building conform architecturally with the dignified governmental buildings in the vicinity and at the same time to make the architectural detail of the utmost simplicity. About $40,000 is to be spent on architectural embellishment and yet the facade drawings already made show a distinctly pleasing type.

Details of Construction

The construction throughout is of reinforced concrete of the beam-and-girder type on 20-ft. panel lengths both ways, with concrete walls and hollow-tile partitions to door height, and glass above to the ceiling. These partitions will be of glazed tile and will not be plastered, but the concrete walls, both outside and inside, will be painted. The windows will be in metal sash. No passenger elevators will be provided but there will be two freight elevators in each unit.

On account of the appearance of the stacks, the Fine Arts Commission would not allow the heating plant to be located at the building, so it is to be near the river, about 1400 ft. away. This plant alone will cost about $450,000.

The building will be designed for ordinary office building loads and is in every way comparable to a modern reinforced-concrete building. It is, however, considered a temporary structure, though no one can predict its period of usefulness or when it will be torn down. In size it is of course remarkable, but building it complete in

five months will be a construction feat of unprecedented effort. The wings and headhouse will be built in groups of four wings and the navy building must be turned out in 4½ months, the whole structure to be completed 15 days later.

The construction will be under the general direction of Rear Admiral C. W. Parks, chief of the Bureau of Yards and Docks, with Civil Engineer Parsons in direct charge. Civil Engineer O. A. Mechlin, U. S. Naval Reserve, is project manager in supervision under Commander Parsons.

New York State May Build Canal Fleet

A bill was introduced into the New York State Senate on Feb. 18 which would enable the canal board to construct, equip, and, if necessary, operate canal boats and other craft. An appropriation is made to enable the state to acquire a controlling interest in corporations to be organized by it for the purpose, the capital stock of which is limited in the aggregate to $2,000,000. Under the bill, which was introduced by Senator Henry M. Sage, the state may build and equip or acquire through lease or purchase the necessary craft for barge canal traffic, and continue the ownership one year after the war, but not longer. The state may then lease the craft to individuals or corporations for operation. In a year following the close of the war the lessees must take over the boats themselves, paying the state a fair value not exceeding the cost of construction.

Should the state during the war be unable to lease boats to private operators, it may operate them itself through the Department of Public Works, which is empowered in the bill to fix transportation rates.

Sewer Explosion at St. Louis, Mo.

An explosion occurred in the Carroll St. sewer, St. Louis, Mo., recently, the cause of which is still under investigation. Manhole covers were blown off and cast-iron trap plates were blown out of the inlets. Windows were demolished near the centers of concussion; the granitoid floor of one store cellar was ripped up and a hole blown in a masonry foundation of the wall at the store front. The frozen ground was cracked along the line of the sewer at least one block. There appears to have been three separate explosions at intervals of a few seconds originating at two centers several blocks apart and on different branch sewers. The main sewer drains a small area near the Mississippi River, part of which is a manufacturing district. The sewers range from pipe up to 4 x 5-ft. brick. A similar explosion occurred about a month ago in north St. Louis, causing about $1000 damage. Its cause is also unknown.

San Francisco Water-Rate Case Makes Progress

Company Presents Evidence—Commission Engineers File Appraisal—City Yet To Be Heard

Hearings on the Spring Valley Water Co.'s application to increase its rates, and on the application of San Francisco to have the rates reduced, were resumed Feb. 4 before the California Railroad Commission. The appraisal of the physical properties of the company made by the Railroad Commission was placed in evidence and several days were spent in examining company witnesses. The city has not yet placed in evidence its estimates for the structures as brought up to date. After taking evidence for a week the case was adjourned until Mar. 18, with the understanding that at that time it would be continued to a conclusion.

The company has claimed that the value of its properties in actual use for supplying water is between $40,000,000 and $45,000,000, and that it earns only 5% net upon this amount. The city contends that the value is much less and that present rates are excessive.

The property of the company was recently valued as of Dec. 31, 1913, in connection with the proceedings before the United States District Court. These proceedings related to rates for the eight years that ended with 1915. During this period the city had fixed rates from which the company had appealed; and the court had permitted the company to collect a rate 15% higher than that established by the city. The additional money so collected has been, and still is, impounded, and the possession of this money will be decided by the Federal Court. The master's report now awaits final action.

Agreement on Reproduction Cost

In the proceeding before the federal court an agreement was reached between representatives of the city and the company as to the reproduction cost of more than half of the structures that were involved. Recognizing these agreements, the estimated cost of reproduction less depreciation as of Dec. 31, 1913, was claimed by the company to be $20,000,000; and by the city, $13,960,000.

In comparison with this, the appraisal by the engineering department of the Railroad Commission sets the reproduction cost less depreciation of the structures of the inventory as of Dec. 31, 1913, at $12,441,054. The finding of the commission is thus about $1,500,000 less than the amount conceded by the city in the case before the federal court, and $7,500,000 below the amount claimed by the company.

In the past four years, the company says, it has expended about $2,300,000 in extending its system. Including the additions, the Railroad Commission allows for structures at the present time $14,349,090. In comparison with this, Allen Hazen estimates for the company that the cost of reproduction less depreciation on the basis of prices that prevailed from 1907 to 1914, and which were used in the previous proceedings, now amounts to $21,700,000. If present actual prices were used the estimate would be raised to $32,000,000.

In addition to the structures, the company owns valuable water rights and some 70,000 acres of land, a large part of which is watershed land bought to protect the quality of the waters in its reservoirs. The company claims some $20,000,000 for the value of its lands and rights. The city's claims in this respect have not yet been presented.

The Company's Works

Mr. Hazen presented a statement of the present condition and required development of the company's works, which may be summarized as follows: The company has acquired land and water rights from which a supply of more than 100,000,000 gal. per day can be developed. These sources are nearer than any others to the city and can be developed at smaller expense than others that might be proposed. This estimate does not include the coast streams on which the company owns certain incomplete rights and from which an additional supply of 50,000,000 gal. per day could be obtained.

The sources of the company have been developed from time to time to meet the growing needs of the community but are still only partially developed. For the last five years the average output has been 40,000,000 gal. per day. This is rather more than can be safely and permanently supplied by the works as they now stand. In fact, it is asserted that it has been possible to maintain the supply during these last five years because of the abundant rainfall in three of the five years.

Ten years ago the works were sufficiently developed to provide all water that was needed. The output was then 32,000,000 gal. daily. During the past ten years construction has not kept pace with growth and there is not now margin enough for safety. The company attributes the inadequate construction of the past ten years to its legal difficulties and to the fact that the rates made for it by regulation have been too low to warrant further investment.

Estimate Based on Growth of Population

G. A. Elliott, chief engineer of the company, presented an estimate of the growth of population and needs for a ten-year interval. This included the construction of a new pipe line from Calaveras reservoir with a capacity of 30,000,000 gal. per day, sufficient at a fair load factor to bring in about one-half of the quantity of water to be made available by the Calaveras reservoir now approaching completion and sufficient to maintain the supply until the consumption is somewhat over 60,000,000 gal. per day, or 50% more than it is now.

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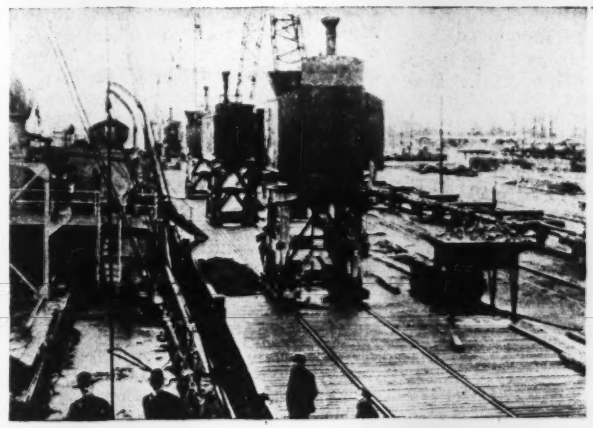
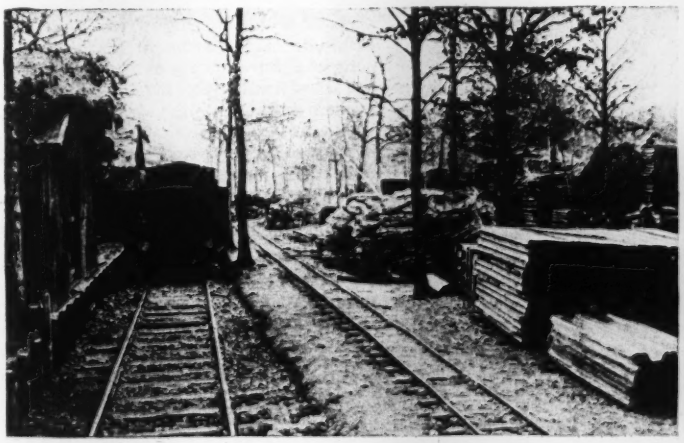
On the Lines of Communication in France



CRANES DISCHARGE AMERICAN SHIPS AT FRENCH PORT—FRENCH ENGINEERS REBUILDING BRIDGE



BARBED WIRE AND MATERIALS AT ENGINEER DEPOT—BALLASTING NEW RAILROAD IN MEUSE DISTRICT

AISNE ROAD RESTORED ACROSS SHELL CRATER—UNLOADING ROAD METAL, CHEMIN DES DAMES SECTOR

French Official Photographs, Copyright by Commitee on Public Information

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known as a *lavoir*. These are generally housed in cut-stone structures. Some of them are very imposing. The washing place proper consists of two shallow stone basins with sloping sides that serve as scrubbing boards. The lower basin is used for soapy operations and the upper for rinsing. I have not followed closely the washing operations but I think the clothes are first boiled in a typical iron kettle with wood ashes and then carted by wheelbarrows to the wash house, and the operation finished in the cold. My clothes give evidences of being washed that way and I am not strong for the system.

"While the little water-supply systems seem crude, they are very much better than wells such as sometimes obtain, because wells in such closely built up villages as exist over here are bound to become more or less polluted."

Government Establishes Route For Aerial Mail Carrying

Fourteen cities extending from Long Island to Texas will be the stations on the aerial mail route soon to be established. The mails will be carried by airplane. If the first experiments are successful, other routes will be mapped out by the Government. Already bids have been asked on carrying the mails by airplane between New York City and Washington.

It is the idea of the Government, according to announcement, to have the airplane fields on the Long Island-Texas route serve as stations for commercial and pleasure planes as well as for those carrying mails.

One of the stations will be Cleveland, Ohio. The city's chamber of commerce has appointed an airplane committee to select a site for a landing place. On this committee are W. A. Stinchcomb, county engineer, and C. E. Thompson, president of the Cleveland Steel Products Company.

Construction To Be Rushed on San Diego & Arizona Railway

Construction has been under way on the San Diego & Arizona Ry., now being built between Yuma, Ariz., and tidewater at San Diego, Calif., for more than two years. The work has not been pushed rapidly and there has been litigation between the Southern Pacific Co. and the Spreckels Co. of San Diego over the control of the road.

Military necessity, it has recently been decided, makes it desirable to complete the line speedily. A compromise has therefore been reached whereby the litigation is abandoned and it is agreed that there shall be a plan of joint operation of the road by John D. and A. B. Spreckels and the Southern Pacific. Under these new conditions construction is to be rushed, it is announced, and governmental release from embargo provisions has been obtained for all supplies and materials needed. The line parallels the Mexican border, generally speaking, and is about 160 miles long.

Lieutenant Colonel Marshall Now Heads Cantonment Division

Construction Branch of Quartermaster's Department Is Made Separate Organization

(Washington Correspondence)

The cantonment division of the quartermaster general's office of the War Department, which has charge of the enormous construction program for the army on this side of the ocean, is in process of reorganization, though at the present time its ultimate arrangement cannot be stated. Brig. Gen. I. W. Littell, who has headed the division since the beginning of the war, has applied for retirement from the service, having served the requisite number of years, and Lt. Col. Richard C. Marshall, Jr., U. S. A., has been placed in charge of the work. Col. Marshall became General (then Colonel) Littell's chief aid in the cantonment work at the outbreak of the war, and has served in that capacity throughout the crowded months since then. He is therefore thoroughly acquainted with the details of the office work.

LT. COL. R. C. MARSHALL, JR.

It is understood that a number of changes are to be made, mainly in redistributing functions and duties, but such changes have not been made public.

Construction work of the army has for many years been assigned to the quartermaster's corps, although overseas structures are taken care of by the corps of engineers. Accordingly, when the war broke out, a branch of the quartermaster's department immediately undertook the construction of the thousands of buildings required to house troops and supplies in this country. A large organization of officers and civilian assistants was soon built from the ranks of engineers and contractors to perform the duties, strictly engineering, which fell to the newly formed cantonment division. Many of the reserve officers assigned to the division, in fact, were members of the Engineer Officers' Reserve.

Although there was considerable feeling at Washington that this work should have been placed under the direction of the Chief of Engineers, nothing was done in the matter until General Goethals became Quartermaster General. He very soon brought the matter to a head by insisting that the work of the cantonment division had nothing to do with the Quartermaster Department's legitimate functions, but was obviously so technical in its nature as to belong to the engineer department. Interdepartmental politics on this controversy of such long standing immediately began to brew, and just what happened is not now a matter of public information. At any rate, it was announced that the cantonment division would be taken from the Quartermaster's Department and made a separate bureau, reporting directly to the Assistant Secretary of War. At present that is its status, although there are rumors that it will be directed to report to the general staff, under the reorganization of that body as recently announced. Meanwhile, on account of the organic law of the army, the Quartermaster General must still approve all of the expenditures of the cantonment division, although it is understood that this is merely a formality and is the only relation between the two bureaus.

Urge Canada To Take Over Railroads

The joint annual meeting of the Ontario Hydro-Electric Railway Association and the Ontario Municipal Electric Association was held in Toronto Feb. 12 and largely attended by representatives of the provincial municipalities of the province.

Resolutions were adopted urging the government to take over the Grand Trunk and Grand Trunk Pacific railways and consolidate them with the railways already taken over; requesting the legislature to provide for two additional representatives on the Hydro-Electric Power Commission to be elected by the municipalities using hydro-electric power; favoring an investigation by the Hydro-Electric Commission and the Power Controller to determine the priority of claims upon the available power; and urging a revision of the Railway Act and giving the municipalities control of their highways. Officers were elected as follows: Honorary president, Sir Adam Beck; honorary vice presidents, the Hon. I. B. Lucas and W. K. McNaught; president, J. W. Lyon, Guelph; secretary, T. J. Hannigan, Guelph.

Capital Issues Committee Instructs Applicants

Will Make Ruling on Proposed Bonds or Stocks After Receiving Full Information

The Capital Issues Committee of the Federal Reserve Board, Washington, has issued the following instructions to applicants with respect to proposed issues of bonds, notes, shares of stock, etc.:

Applications should be addressed to the Capital Issues Committee, 718 Metropolitan Bank Building, Washington, D. C. No prescribed form of application is required, but the applicant should provide all the information which is appropriate to the proposed issue, or which would facilitate the speedy decision of the committee. For the guidance of applicants the following suggestions are made:

The purpose of the issue should be fully and accurately described. If the purpose is to refund, fund, or pay or extend outstanding bonds, obligations, or indebtedness, describe fully the nature and character of bonds, etc., to be refunded and state briefly the time or times and the general purposes for which unsecured indebtedness was incurred. If the issue is to be made for war purposes or to raise capital in connection with war contracts or war supplies, or to provide equipment, buildings, or facilities of any kind for war work, full description thereof and amounts needed therefor should be stated.

If any war purposes are involved, reference should be made to the proper governmental authorities at Washington and elsewhere to enable definite information and corroboration to be obtained directly by the committee. If the issue is deemed necessary on account of any governmental requirement, National, State, or municipal, or of any commission or public authority, describe the same in full. If the issue is deemed necessary for reasons of public health or welfare, or other public economic necessity, describe the same in full. If the issue is made for private financial requirements and no public interests are involved, a very clear exposition of necessity will be desired.

In all cases full reasons should be given why the proposed issues can not be postponed until after the war, or why the necessity is greater than the paramount need of the National Government in conserving the financial resorces, materials, and labor of the country for the war.

It will be necessary to identify the issues accurately before a final opinion is expressed. For that purpose the following information, when appropriate, should be furnished:

With regard to proposed issues of bonds, notes, certificates of indebtedness, and other securities (State, county, municipal, or corporate) (1) Name, amount, date, and dates of maturity, and serial numbers of the proposed bonds, notes, or other securities; (2) amount of total authorized issue of which proposed issue is part; (3) attested copies of votes, ordinances, or resolutions authorizing proposed issue; (4) attested copy of mortgage, deed of trust, or similar instrument under which proposed issue is made or by which it is to be secured; (5) last balance sheet if a corporation and copy of charter and by-laws, if in print.

With regard to proposed issues of shares of stock (1) Total capitalization of company; (2) last balance sheet and copy of charter and by-laws, if in print; (3) total authorized issue of stock of which proposed issue is part; (4) amount of proposed issue, method and dates of issue, whether by offer to shareholders, sale, or public subscription; (5) attested copies of votes authorizing proposed issue.

Henry H. Vaughan, Recently Elected President of Canadian Civil Engineers

HENRY H. VAUGHAN

Germany Turning Also to Concrete Ship Construction

German shipbuilders have been quick to take up the idea of constructing ships of concrete, according to Capt. L. Persius, who writes in the *Berliner Tageblatt* that, owing to prospective shortage of wood, steel and iron for shipbuilding after the war, leading German and Austrian dockyards are preparing to use ferro-concrete on a large scale. Yards are now being reconstructed to that end.

As told in the London papers, Captain Persius takes the view that all the great shipbuilding countries will be put to the same necessity as Germany to find substitutes for wood, iron and steel. Germany, he says, possesses the most important cement industry in the world.

Civil Service Examination

Because of the large number of engineering positions under civil service in Ohio, the State Civil Service Commission, Columbus, wishes to employ an engineer as assistant chief examiner. An engineering graduate is desired, with not less than five years' responsible experience, at least two of which must have been in some capacity requiring the employment and supervision of assistants. Three points will be given for education, 6 for experience in positions of responsibility and 1 for plans for organization and procedure. The examination is unassembled, open to male residents of the United States who are between the ages of 25 and 45. The salary is $3000. Applications will be received up to the close of business Apr. 1.

Ontario Appropriates $9,054,951 for Hydro-Electric Power

The government of Ontario has appropriated $9,054,951 for expenditure on capital account by the Provincial Hydro-Electric Power Commission. The principal items are as follows: Chippawa Creek development, $4,175,000; Niagara system extensions, $2,865,000; Central Ontario system extensions, $588,000; Severn system, $405,000; Eugenia Falls system, $233,000; Port Arthur system, $150,000; St. Lawrence system, $251,000; Rideau system, $117,000; Nipissing system, $60,000.

World's Salesmanship Congress

The third annual session of the World's Salesmanship Congress has been called for the month of April, two months in advance of its regular date. The congress will meet in Detroit Apr. 24-27. Its function is "the betterment of business through the betterment of salesmanship." Among the speakers will be H. N. Casson, of London, England, proprietor of *Efficiency Magazine*.

Water Famine in Southern Kansas Serious

Shortage of water in southern Kansas, due to the long winter drought, has led the city commissioners of Coffeyville to notify the citizens that no water will be supplied from the municipal water-works until rains come in sufficient quantities to make the surface water safe. At Parsons the board of education has ordered that water from cisterns fed from the buildings be used in place of city water.

Destructive Storm in Kansas

A destructive storm on the night of Feb. 27 swept over a section of southern Kansas some 100 miles long and 20 miles wide, including the towns of Yates Center and Iola. It did much damage to small buildings and railway stations, tore the end out of one large church in Iola and destroyed smelter works east of that city.

San Francisco Water Rate Case

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To build this pipe line will cost at prices that prevailed before the war between $7,000,000 and $8,000,000. The extension of the distribution system, new reservoirs, new pumps and other expenditures, Mr. Elliott said, will bring the required investment for the next ten years at those prices to $13,000,000 or $14,000,000. But there is no assurance that such prices can be realized on future construction. If prices of the next ten years should be 50% higher, as seems not unlikely, the required investment will exceed $20,000,000.

The company asks that rates be fixed that will permit it to command the needed new capital for the development of the sources to meet the growing needs of the city, and says that to do this the rates must be such as to permit earning an attractive rate of return on the new capital needed; also that the recognition of the company's present holdings shall be such as to command the confidence of the investing public.

Nebraska To Hold Road Institute

The first Nebraska Road Institute will be held at the University of Nebraska Mar. 11 to 15, inclusive, and will be conducted by the Engineering College of the University in coöperation with a number of prominent Nebraska engineers and road builders. There will be no charge for attendance.

Some of the following subjects that will have special prominence on the program are: Effect of War Conditions on the Building and Maintenance of Roads, Need of Better Roads, Automobile Accidents on Public Roads, Relation of Wear on Automobile Equipment and Loss of Fuel to the Condition of the Public Roads, Federal and State Roads Laws, Formulated Rules for the Administration of Federal Aid Funds and Methods of Procedure for Securing Federal and State Aid for Road and Bridge Improvements, Road Location and Design, Road Surveys, Staking Out Work, Grading and Grading Machinery, Maintenance of Roads and Bridges, Culverts and Small Bridges, Proportioning and Mixing of Concrete, Road and Bridge Records and Reports.

Those desiring further information may address Prof. Clark E. Mickey, University of Nebraska, Lincoln.

France and England Plan Great Harbor Works

Port facilities to accommodate a material development of shipping traffic in the future are receiving attention in France and England in spite of the general concentration of energies on the war. The public works department of the French government has presented a program for large extensions to the port of Havre, at an estimated cost of $40,000,000, divided equally between the city and the government.

Fifty Millions for Shipping Housing Now Available

Bill Appropriating Similar Amount for Facilities Under Department of Labor Is Before Congress

The President has signed the act of Congress appropriating $50,000,000 for housing shipyard workers. The fund will be administered by the United States Shipping Board. In prospect of such action the Emergency Fleet Corporation has for a long time been organizing its housing forces under the direction of J. Rogers Flannery, president of the American Vanadium Co., of Pittsburgh. It is now announced that Mr. Flannery will head the housing division of the corporation and will be assisted by Meyer Bloomfield, until now head of the industrial service division of the Fleet Corporation.

Plans and construction have already progressed far in one shipyard, that at Bristol, as described in these columns, and a special allotment of $8,000,000 for similar purposes has just been made for one of the other Government yards at Hog Island, Philadelphia. No housing will be provided at the Submarine Boat Corporation's plant at Newark, N. J., the third Government agency plant.

Mr. Flannery has announced that the new funds will be expended not only in the outright purchase and construction of houses at the Government yards, but in improving transportation facilities and in loaning money for housing to the private yards engaged on Government contracts.

On Feb. 28, Representative Frank Clark, of Florida, chairman of the Committee on Public Buildings and Grounds, introduced a bill in the House of Representatives appropriating $50,000,000, to be expended under the direction of the Secretary of Labor "for the purposes of providing housing, local transportation and other community facilities for such industrial workers as are engaged in industries connected with and essential to the national defense, and their families, only during the continuation of the existing war." This bill supersedes the one taken from the Committee on Labor by Mr. Clark's committee and is the only housing bill now before Congress. The bill gives the broadest powers to the Secretary of Labor except that it forbids him to make a "percentage or cost-plus contract for any work under this act."

The Secretary of Labor has made Otto M. Eidlitz director of housing of the department, and he will presumably administer the funds provided by the new bill if it is enacted.

Missouri Highway Engineers Hold State Convention

The 11th annual meeting of the Highway Engineers Association of Missouri opened in Kansas City on Feb. 27, and continued for three days. Over a hundred members from various parts of the state were in attendance at the opening meeting, at which Alexander W. Graham, state highway engineer, delivered a talk on "What the State Highway Engineer Expects of County Highway Engineers in 1918." At the same session papers were read by B. H. Bain and T. C. Stanley on technical aspects of road engineering.

Other papers were read by C. E. Smith, consulting engineer, St. Louis; J. C. Travilla, consulting engineer for the Dunn Wire Cut Lug Brick Co.; Harvey S. Owen, engineer with the Portland Cement Manufacturers' Assn., and S. M. Williams, president of the Highway Industries Assn. After the third session, Prof. E. J. McCaustland, of the University of Missouri, spoke concerning the coöperation of the university with the highway projects of the state, and Walter Buehler, of the Barrett Manufacturing Co., concerning the bituminous treatment of hard-surfaced roads.

Missouri County Bonds Invalid—New Election Probable

The recent bond issue for $2,000,000 voted by the electors of Buchanan County, Mo., for road purposes, has been declared invalid on the grounds that election booths were not used and voters had not been notified of the new location. The majority at the election was 5 to 1 in favor of the bond. It is nearly certain that a new election will be held. In the opinion of close observers the favorable majority will be raised to at least 10 to 1.

Arkansas Public Utility Convention

The state convention of the Arkansas Association of Public Utility Operators will be held at Hot Springs, Ark., on May 21-23.

ENGINEERING SOCIETIES

The recent joint conference of the agricultural, livestock, engineering and irrigation societies of Idaho elected the following officers: R. E. Shephard, Jerome, president; N. K. Jensen, Rupert, secretary and treasurer.

At the meeting of **The Engineers' Club of Cincinnati**, Feb. 21, J. E. Freeman, of Chicago, engineer of the technical division of the Portland Cement Association, spoke on the building of concrete ships.

At the meeting, Feb. 28, of **The Yale Engineering Association of New York**, members of **The Harvard Engineering Society of New York** were invited guests. The meeting was addressed by President Herr, of the Lake Engineering Association and Professor Breckenridge, and there was also a short address by S. R. Bertron, a member of the Root Commission to Russia. Moving pictures of recent occurrences in

Calendar

Annual Meetings

AMERICAN RAILWAY ENGINEERING ASSOCIATION; 910 Michigan Ave., Chicago; Mar. 19-21, Chicago.

AMERICAN WATER-WORKS ASSOCIATION; 47 State St., Troy, N. Y.; May 13-18, St. Louis, Mo.

Russia were presented by Capt. Donald Thompson.

The Engineers' Club of Trenton, N. J., at its meeting Feb. 28, had as its guest Dr. J. A. L. Waddell, who spoke on "Engineering Fifty Years Hence." His address was illustrated with lantern slides and motion pictures.

The Canadian Society of Civil Engineers, at its meeting Feb. 28, was addressed by P. B. Motley, engineer of bridges, Canadian Pacific Ry., whose subject was "Tests of Chain Guards on the Panama Canal."

The author of the paper is Henry Goldmark, but it was read by Mr. Motley in Mr. Goldmark's unavoidable absence from Montreal. The paper was illustrated by lantern slides.

After a meeting, Feb. 26, of the iron and steel section of **The Cleveland, Ohio, Engineering Society,** a paper on "Forging of Three-Inch Shells" was read by S. H. Smith, chief engineer of the Hydraulic Pressed Steel Co., Cleveland. On Mar. 5, F. A. Ray, professor of mining engineering, Ohio State University, will speak on "Experiences in Russia," and on Mar. 12, G. D. Wardrop, editor of *Aerial Age Weekly,* New York, will speak on "Airplanes." The society recently organized a fuel service committee to instruct the public in proper and economical methods of using coal.

The regular monthly meeting of **The Engineers' and Architects' Club of Louisville, Ky.,** was held Feb. 19. A paper on "Concrete Ships" was read by J. E. Freeman. Officers elected for the ensuing year are Addison W. Lee, Jr., president; Hermann Wischmeyer, secretary.

At the bimonthly meeting of the structural section of **The Engineers' Society of Western Pennsylvania,** held Mar. 5, in Pittsburgh, the principal feature was the reading of an illustrated paper on "Simplification of Riveted-Joint Design," by H. A. S. Howarth, Pittsburgh.

The Oregon Society of Engineers has elected the following officers for 1918: President, O. E. Stanley; treasurer, Henry W. Morse; secretary, C. J. Hogue.

The March meeting of The New England Water-Works Association will be held in Boston, at the Hotel Brunswick, Mar. 13. Among the features of the program will be the reading of the following papers: "The Past and Present Pumping Equipment of the Manchester Pumping Stations," by James H. Mendell, Superintendent of Water-Works, Manchester, N. H.; "Recent Legislation and Decisions of the Courts with Reference to the Sanitary Protection of Water Supplies," by Albert L. Sawyer, water registrar, Haverhill, Mass.; "Mountain Scenery," illustrated with colored slides, by Desmond FitzGerald, Consulting Engineer, Brookline, Mass. Before the luncheon and the reading of the papers the executive committee will meet.

The Kansas City Chapter of the American Society of Heating and Ventilating Engineers listened at a recent meeting to a paper on "Heating and Ventilation of Army Camps and Cantonments," by B. Natkin, of Kansas City.

The Montana Society of Engineers at its annual meeting in Butte, elected the following officers: President, Willis T. Burns, Butte; secretary, Clinton H. Moore.

The Indiana Sanitary and Water-Supply Association will hold its annual convention at the Claypool Hotel, Indianapolis, Mar. 27-28. The secretary is W. G. Ulrich, of the Indianapolis Water Company.

A chapter of **The American Association of Engineers** is now being organized in Philadelphia, Penn. For the present, meetings are open to all engineers. The next meeting will be held at the Hotel Walton, Mar. 12. Temporary officers are F. P. Roth, chairman, and H. F. Kuzel, secretary.

The luncheon talk of **The Engineers' Club of San Francisco** on Feb. 26 was made by Charles T. Hutchinson, managing editor of *Western Engineering,* who described methods used and results achieved in obtaining technical men for Government service.

The Pittsburgh Assn. of Members of the American Society of Civil Engineers at a luncheon Mar. 21 will entertain as guest of honor Maj. Gen. Charles Clement.

The Association of County Engineers of Iowa held a meeting at Ames, Feb. 27-28, under the auspices of the State Highway Commission. Plans for the new year in road and bridge work were discussed.

The annual convention of the **Ontario Good Roads Assn.** was held in Toronto Feb. 27-Mar. 1 with a good attendance. A number of technical papers was read and addresses were delivered. The Hon. Findlay Macdiarmid, Ontario Minister of Public Works, announced that all the counties in the province with two exceptions were coöperating in the good roads movement. The question of placing a tax of 2c. per ft. on property facing county roads was discussed, but a resolution to that effect was defeated. Officers were elected as follows: Honorary presidents, J. A. Saunders and S. L. Squires; president, C. R. Wheelock; secretary-treasurer, Geo. S. Henry.

The Municipal Engineering Society of Flint, Mich., composed of men employed in the city's engineering department, elected Feb. 20 the following officers: President, E. C. Shoecraft; secretary, Robert Knapman.

The Texas Association of Members of the American Society of Civil Engineers will hold its postponed regular annual meeting at Dallas, Mar. 9.

At the meeting of **The Albany Society of Civil Engineers** on the evening of Mar. 29, the speaker will be J. Waldo Smith, of New York, chief engineer of the New York Water Supply Commission. Mr. Smith will describe the new system water supply for New York City.

The North Dakota Society of Engineers had a record-breaking attendance at its tenth annual convention, held at Fargo, N. D., Feb. 21-22. The proceedings gave special attention to land drainage and highways, and also to the distribution and consumption of fuel. Officers for 1918 were elected as follows: President, E. J. Thomas, city engineer of Minot; vice-presidents, G. W. Heinmiller and W. R. Veigel, city engineers of Carrington and Dickinson. Prof. E. F. Chandler, University, N. D., is secretary. The next annual meeting will be held at Valley City.

At the next regular meeting of **The New York Chapter of the American Association of Engineers,** to be held Mar. 13, at the Hotel McAlpin, E. W. McKnight of the First Canadian Expeditionary Forces, will speak on "Wartime Experiences."

PERSONAL NOTES

ERNEST B. BLACK, of Black & Veatch, consulting engineers, Kansas City, Mo., has been commissioned captain in the finance division of the aviation section of the Signal Corps, U. S. A., and put in charge of appraisal of property at plants manufacturing airplanes.

JOHN W. NEVINS, engineer, and EARL G. PARK, architect, both of whom have been connected for 16 years with the archiectural firm of Bebb & Gould, Securities Building, Seattle, have formed a partnership and have opened offices in the Hoge Building, Seattle.

ARTHUR L. PAULS, formerly with the U. S. Reclamation Service, has joined the staff of the Miami Conservancy District at Dayton, Ohio. His connection with the Reclamation Service began in 1910, and he has been engaged principally on the irrigation

project near Boise, Idaho. He was assistant engineer in charge of all field surveys and inspection during the construction of the Arrowrock Dam. Mr. Pauls is a gradute of the University of Idaho, 1909.

DR. EUGENE R. KELLEY has been appointed to succeed Dr. Allan J. McLaughlin as Commissioner of Health of Massachusetts and will assume office Mar. 31. Dr. Kelley was formerly Health Commissioner of the State of Washington and became connected with the Massachusetts department when it was reorganized, in 1914, as chief of the division of communicable diseases.

MAYO TOLMAN, chief engineer of the West Virginia Department of Health, has gone to Guatemala for three months in the interest of the American Red Cross. He will engage in relief work made necessary by the recent earthquake. Mr. Mayo has not resigned his state position but has received a three months leave of absence. The duties of his office will be performed by A. N. Wardle and Ellis S. Tisdale, both graduates of the Massachusetts Institute of Technology. Mr. Wardle will act also as superintendent of filtration for the West Virginia Water and Electric Co. at its Charleston plant, a position held for some months by Mr. Tolman and which he will probably resume when he returns from Central America.

D. R. LYMAN, for the past eight years chief engineer of the department of engineering of Louisville, Ky., has resigned. His resignation takes effect Apr. 1.

HAROLD W. HORNE, since 1912 division engineer in charge of construction of reservoirs and dams for the additional water supply for Hartford, Conn., recently joined the engineering staff of the Miami Conservancy District, Dayton, Ohio. Previous to his connection with the Hartford water supply he was section engineer for the Board of Water Supply, City of New York, in charge of a section of the Catskill aqueduct, on the Hudson River division. Mr. Horne was graduated from Harvard University in 1896.

J. A. TINSMAN, assistant engineer, Pennsylvania State Department of Health, has been commissioned first lieutenant in the Sanitary Corps, National Army. He was granted leave of absence.

C. E. MYERS, district engineer, Pennsylvania State Highway Department, has been commissioned captain in the United States Engineer Reserve Corps, and assigned to duty at Camp Lee, Virginia.

VINCENT P. ODONI has left Tucson, Ariz., for Dayton, Ohio, where he will be a member of the engineering staff of the Miami Conservancy District. Mr. Odoni was for a number of years chief engineer of the Tucson Farms Co., in charge of design, construction and operation of extensive pumping installations for irrigation. Previous to that time he was engaged in engineering in Colorado for the Central Colorado Power Co., and later had charge of the construction of a hydroelectric plant near Idaho Springs, Colo. Mr. Odoni was born in Switzerland and received his engineering education at Zurich, where he was graduated in 1904. He came to the United States in 1907.

ULDRIC THOMPSON, JR., formerly chief engineer of the International Steel and Ordnance Corporation, and who has been serving until recently in an advisory capacity in equipping the new artillery ammunition plant at the Rock Island Arsenal, has opened an office at 120 Broadway, New York City, under the firm name of Uldric Thompson, Jr., Inc., consulting and industrial engineers.

G. W. BUCHHOLZ, until recently assistant chief engineer of the Snare & Triest Co., has resigned to become one of the executive engineers of Fred. T. Ley & Co. Mr. Buchholz was formerly chief engineer of the Northeastern Construction Co., and joined the staff of the Snare & Triest Co. in 1916.

JOHN R. KNEEBONE of the Flint, Mich., city engineer's staff has become city manager of Beaufort, S. C. He is the youngest city manager in the United States. He has been in Flint since July 1, 1916, serving for six months as civic secretary for the St. Paul Men's Club and more recently being engaged in cost accountant work in the city engineering department. Mr. Kneebone is a graduate of Houghton High School and received his A. B. at the University of Michigan in 1915. The university has given him the new degree of "master of arts in municipal administration." He is one of three men to enter this course, the first to be given in the United States, and is the first to complete it, the other two men having left the university to take positions as city managers. At Beaufort he has succeeded Harrison Grey Otis, who becomes city manager at Auburn, Maine.

W. R. GOSS has resigned as superintendent of the municipally owned water and sewer system of Shreveport, La. His resignation is effective Mar. 15.

JOHN W. CERNEY, constructing engineer, Denver, has been appointed major in the Quartermaster Corps and will act as a constructing engineer at army cantonments.

E. C. JOHNSON has been selected as resident engineer for the building of the powder plant at Nashville, Tenn., by the Du Pont Engineering Company.

GLEN S. ALLEN of McAlester, Okla., has been appointed county engineer of Sequoyah County, Oklahoma.

EDWARD E. WEAVER, city engineer of Independence, Kan., has resigned to accept a position with the Central States Oil Company.

E. S. BELDEN, vice-president of the George W. Fuller Construction Co., who has been in charge of the company's Kansas City office since 1911, has been transferred to Chicago, to take charge of the office there. F. E. Warren will succeed Mr. Belden at Kansas City.

JOSEPH HOGAN, who has been engineer at Lyons, N. Y., for the Lathrop, Shea, Hinwood Co. on barge canal work, has gone to Philadelphia, where he is now associated with D. L. Taylor & Co., in the building of a dry dock at the League Island Navy Yard.

E. P. LAKEMAN, city engineer of Haleyville, Ala., has resigned to become cashier of the Traders & Farmers Bank of the same city.

FREDERIC H. LOUD, formerly civil engineer and surveyor at St. Ignace, Mich., is now a first lieutenant in the Field Artillery, National Army, in France.

O. RITTMASTER, formerly with the Chicago, Milwaukee & St. Paul Ry., is now a mining engineer with the Oliver Iron Mining Co., Ely, Minn.

GABRIEL R. SOLOMON, of the firm of Solomon-Norcross Co., consulting engineers, Atlanta, Ga., has been commissioned as major in the Engineer Reserve Corps and assigned to the engineering staff of the cantonment division. He is at present stationed in New York City in the office of D. C. Jackling, director in charge of the construction of the United States Government smokeless powder plants at Charleston, W. Va., and Nashville, Tenn. Mr. Norcross is supervising engineer at Camp Humphreys, Belvoir, Va. The firm of Solomon-Norcross Co. has been engaged in cantonment work for the government since last April on a number of camps in the South and West. The general practice of the firm will be continued as heretofore with headquarters in Atlanta.

IVAN E. GOODNER, for the past two years chief engineer of the Paradise Irrigation District, California, has been appointed a member of the engineering staff of the Miami Conservancy District, Dayton, Ohio. Previous to his connection with the irrigation company he was connected with the mining operations of the Aurora Consolidated Mines Co. of Nevada. Mr. Goodner is a graduate of South Dakota School of Mines, 1908.

JOHN CHAMBERS, who was at one time city engineer of Louisville, Ky., and consulting engineer during the construction of the new City Hospital, has been appointed city engineer to succeed David R. Lyman, resigned. He was in charge of the work of constructing the sewer which connects Camp Zachary Taylor with the Beargrass intercepting sewers.

A. LEWIS BURRAGE, Benton Harbor, Mich., has been promoted to the rank of captain and is now a member of the headquarters staff of the 43d Engineers at Camp American University, Washington, D. C. Captain Benton left the engineering department of Purdue University in 1905.

ANDREW SCHULTZ, plant engineer of the Bell Telephone Co. at Harrisburg, Penn., has been appointed plant engineer at Pittsburgh, effective Mar. 1. He is a graduate of the class of 1909 of Cornell University, and entered the employ of the Bell Telephone Co. as student engineer at Philadelphia in 1909.

ROBERT C. GLANCY, construction engineer of the Bell Telephone Co. at Philadelphia, has been appointed plant engineer at Harrisburgh, Penn., to succeed Andrew Schultz. Mr. Glancy is a graduate of the class of 1909, Massachusetts Institute of Technology, and entered the employ of the company as student engineer following his graduation.

WILLIAM T. HENSLEY, of Indianapolis, has been appointed major in the ordnance department, gun division, U. S. A.

K. H. SHRIVER, junior engineer, who is in charge of the construction of Lock and Dam No. 21, Ohio River, has been appointed first lieutenant, Engineer Reserve Corps, and placed on the inactive list for an indefinite period by the Chief of Engineers, due to work to be done on the Ohio River.

R. C. STARR, formerly hydraulic engineer for the Southern California Edison Co., has resigned to become superintendent of construction for Stone & Webster, at Seattle, Wash. Mr. Starr had charge of the extension of the Big Creek dams in southern California, described in recent issues of *Engineering News-Record*, which were completed under Mr. Starr's supervision.

HARRY F. BASCOM has been elected city engineer of Allentown, Penn.

P. E. FULLER, who has been engaged in reclamation work in the West, and who for the past 12 years has been in the employ of the Government in the investigation of underground water resources, power, pumping and irrigation works, will be associated with the Detroit testing laboratory in charge of its general engineering department.

MAJ. GEORGE S. MINNISS has been announced as quartermaster, Second Provisional Brigade, stationed at Camp Wadsworth, Spartanburg, S. C.

WALTER LUNEY, of Luney Bros., general contractors, Victoria, B. C., has been appointed superintendent of construction of the Ogden Point assembling plant being built for the Imperial Munitions Board. Mr. Luney succeeds the late Henry A. Bayfield.

STANLEY T. SCOTT, who has been identified with the contracting business in the Northwest for seven years, was recently elected president of the Washington Machinery and Equipment Co. in Seattle.

C. RAUSCHER, until recently with Westinghouse Church Kerr & Co., Inc., at Fort Wayne, Ind., is now with the Central Construction Co., at Magnolia, Md.

MAJ. FREDERIC A. REIMER, of the First Battalion, 104th Engineers, stationed at Camp McClellan, Anniston, Ala., will assume the duties of county engineer of Essex County, New Jersey, having resigned from the army.

JOHN H. SMITH resigned as head of the state engineering department of Idaho, the resignation becoming effective Mar. 1.

OBITUARY

SIR ALEXANDER M. RENDEL, who died recently in London, was a distinguished British engineer and a member of a family which had given several men of mark to the profession. His father, James Meadows Rendel, was the sixth president of the Institution of Civil Engineers, 1851-52. Sir Alexander was the senior partner in the firm of Rendel, Palmer & Tritton and consulting engineer to the India office. He was born in 1829 and was educated at Cambridge, winning honors in mathematics. The older Rendell dying, he was called upon at 27 to succeed his father as engineer to the London Dock Company. He was connected with dock and harbor works in Great Britain and Ireland, but most of his professional life was passed in India and he designed two of the most noted bridges in the world, the Lansdowne Bridge over the Indus at Sukkur, and the other the Hardinge Bridge over the Ganges. Mr. Rendel became Sir Alexander Rendel in 1887, when he was made a Knight Commander of the Indian Empire.

Extended obituary notices of Sir Alexander Rendel were published in *Engineering* and *The Engineer* of Feb. 1.

DUNCAN D. MCBEAN, contractor, who built the tunnel under the Harlem River, New York City, through which the Lenox Ave. branch of the Interborough subway runs, died in New York, Feb. 27. He was identified with the construction of large tunnels throughout the country, among them the La Salle St. tunnel in Chicago, the Detroit River tunnel and the Siskiyou tunnel on the California-Oregon border line. He was the inventor of the subaqueous sectional tunnel, which is built on land before it is sunk into a river bed and joined. He built also the section of the Northern Pacific Railroad between Cheney and Spokane Falls, Wash., and the foundations for the Ainsworth Bridge over Snake River in Washington. When he went East he was first with the firm of Brown, Howard & Co., which built the northern thirteen miles of the Croton Aqueduct. He was one of the contractors for the Riverside Viaduct, the 145th Street Bridge over the Harlem, and the 155th Street Viaduct, New York City. Mr. McBean was born in Glengarry County, Ontario, in 1848.

HARRY SMITH MORROW, hydraulic engineer and vice-president and general manager of the T. A. Gillespie Co., New York, died Mar. 4. He was 44 years old. After completing a course in engineering and construction, Mr. Morrow entered the employ of Baker, Smith & Co., manufacturers of steamheating appliances. While with the T. A. Gillespie Co. he was in charge of the building of part of the New York State Barge Canal and the construction of a pipe line from Storm Mountain, carrying it 900 ft. under the Hudson River, as a part of the New York City aqueduct system.

MAX J. BURGDORF, one of the construction engineers in the building of the Cripple Creek & Colorado Springs R.R., and engineer for the company since the completion of the road, died Feb. 12, at Colorado Springs, Colo.

JAMES BRYAN, 56 years old, consulting engineer, and an authority on street railway construction, died at Pittsburgh, Feb. 20. He was born in England and came to America about 28 years ago.

DR. SAMUEL G. DIXON, commissioner of the Pennsylvania Board of Health, died Feb. 26 in Philadelphia. He was 66 years old. Dr. Dixon was appointed commissioner in 1905, when the department was created, and was renamed by each Governor. He was graduated from the medical department of the University of Pennsylvania in 1866, and studied in Europe. In 1889 Dr. Dixon became professor of sanitary engineering at the University of Pennsylvania, and in 1890 professor of bacteriology and microscopical technology at the Academy of Natural Appliances in Philadelphia. He was an authority on tuberculosis.

LOWELL HENRY STONE, city recorder in the civil engineering division of the Department of Streets and Public Improvements, Des Moines, Iowa, died Feb. 24. He was born at East Cambridge, Mass., Nov. 15, 1847, and was graduated from the Rensselaer Polytechnic Institute, receiving his degree of civil engineer in 1869. He was locating engineer on the Minneapolis and Kansas City line of the Chicago Great Western Ry., and was engaged on several other railway works. He began work in the engineering department of Des Moines in 1892. From 1904 to 1906 he was assistant city engineer under John W. Budd. At one time he was president of the Iowa Engineering Society.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Canals Ready To Help Handle Freight Traffic

New York Barge Canal Prepared—Railroads Urge Use of Waterways

America's rivers and canals promise to bear a larger share of the traffic burden this year. A committee on inland waterways recently appointed by Secretary McAdoo is making a rapid survey of the principal inland water traffic routes of the nation in order that freight, particularly coal and iron ore, may be diverted to water lines in the largest possible volume.

In the South increased use of the Warrior and Tombigbee River Canals from the Alabama coalfields to the Gulf is contemplated. The Chesapeake & Ohio Canal is expected to handle considerable coal tonnage.

Two important additions to the freight carrying capacity of the country this year are expected in the New York State Barge Canal, connecting the industrial centers of the Great Lakes with the Atlantic seaboard, and the canals of Eastern Pennsylvania and New Jersey. The Barge Canal will be ready for service with the opening of navigation, it is stated. In Philadelphia the railroads and the shipping interests represented by the Philadelphia Bourse are planning to use the canals which tap the anthracite coal mining regions, and the Delaware and Raritan Canal, which parallels the rail lines to New York.

Manufacturers who are interested in the development of the inland waterways of this country from the standpoint of relieving railroad congestion, recognize in the early opening of the New York State Barge Canal the first important step in aiding the nation's overworked railroad plant.

According to Terminal Engineer Maurice W. Williams of Albany, the Barge Canal is expected to be ready for traffic at the opening of navigation this spring. Terminals and stations on the canal are sufficiently advanced and freight handling equipment has been installed.

Operating Companies Organized

Several companies are contemplating the operation of freight lines on the Barge Canal.

Many of the terminals in upper New York State are ready for traffic. These include such cities as Utica, Rome, Amsterdam, Schenectady, Troy and Albany. Other important terminals are well along, such as Erie Basin (Buffalo), Rochester, Syracuse and Oswego.

At Buffalo the Erie Basin terminal is ready for the installation of the permanent heavy freight-handling equipment but temporarily portable machinery will be used so that operation of the terminal may start immediately.

Sites have been secured for more than 55 barge canal terminals and some outlay made at 50 of these. More than 20 freight sheds of frame construction have been rushed through to accommodate the early traffic, while other sheds are being built of durable materials for permanent use. At 17 terminals temporary timber cranes have been furnished to handle freight. Fourteen portable cranes have been ordered recently in addition. Two electric portable conveyors are being built under contract by the Brown Portable Conveying Machinery Co., one of which will be used at Schenectady, and there are under contract five 10-ten derrick cranes for various terminals.

More Heavy Equipment Needed

A great deal of the heavy handling equipment is still needed; $200,000 worth of portal and semi-portal cranes and nearly $200,000 worth of locomotive cranes will be needed, prices calculated at pre-war figures. On account of the scarcity of this equipment it may be necessary to ask for bids on first-class "used" cranes.

Regarding terminals in New York City the State now owns eight sites and plans to secure several more. Here is the status of construction in New York City: Pier 6 East River has been rebuilt at an expense of $100,000, and a freight shed costing $128,000 is under construction on it. The contract at Gowanus Bay, Brooklyn, calling for a long bulkhead and considerable dredging, is complete at a cost of $304,661, and a contract is now in force for the construction of a pier 1200 ft. long and 150 ft. wide which will cost $510,000. At Mott Haven (138th St. and Harlem River) a contract for the bulkhead construction and grading to the value of $191,195 is more than half finished. At Greenpoint a pier and bulkhead to cost $211,000 are well under way, and a pier is being built at W. 53rd St. for $266,000. All work now under construction in New York is progressing satisfactorily, in spite of considerable difficulty in securing some of the materials.

It is expected that the full depth of 12 ft. will be maintained throughout the Barge Canal. The channel will take care of the largest boat which can get through the locks, which are 43 ft. x 300, although the headroom under canal bridges is 15½ ft. Drafts from 8 ft. to 9½ ft. will be the best from an operating point of view.

In response to a memorandum from Director General McAdoo to the inland waterways committee the industrial interests of Philadelphia, acting through the Philadelphia Bourse, are planning an extensive use of the canals that link Philadelphia with New York and the anthracite mining regions. The three railroad companies that control the canals have pledged to the Philadelphia Bourse their support in the movement.

Following the assurances received from George Dallas Dixon, vice-president in charge of traffic of the Pennsylvania Railroad, that this system would go the limit to assist the Bourse in encouraging larger movement of freight through the canals, letters pledging their coöperation have been received from Agnew T. Dice, president of the Philadelphia & Reading Ry., and Rollin H. Wilbur, vice-president of the Lehigh Coal and Navigation Company.

The Pennsylvania R.R. controls the Delaware & Raritan Canal; the Philadelphia & Reading Ry. operates the Schuylkill Canal, and the Lehigh Coal and Navigation Co. controls the Lehigh Canal. It is the contention of the Bourse that if these waterways were used to their capacity in carrying coal and other freight, sufficient fuel could be brought to Philadelphia during the summer to provide for industrial and domestic needs throughout next winter and thus avert another coal famine. Shipment by the waterways, incidentally, will relieve the railroads of the heavy traffic demands that are now being made on them.

The letters that were received from the officials of these companies were in reply to communications which had been sent out by Emil P. Albrecht, president of the Bourse, at the request of Director General McAdoo's recently appointed inland waterways committee. In the commission's request for data regarding the steps that would have to be taken to bring about greater ultilization of the canals was a memorandum from Mr. McAdoo in which he let it be known that he "desired that this work be pushed with all possible speed, since the time is short for the development of the necessary facilities for use this season."

Gasoline to Replace the Mule

Conferences are now being held by Mr. Albrecht with the officials of the Pennsylvania R.R. with a view to reaching a definite plan for submission to Washington authorities regarding speeding up the movement of freight via the Delaware & Raritan Canal, which connects the Delaware and Raritan Rivers and offers an inside water route between Philadelphia and New York. Mr. Albrecht also

will confer with President Dice of the Philadelphia & Reading relative to the Schuylkill Canal, and Vice-President Wilbur of the Lehigh Coal and Navigation Co. regarding the Lehigh Navigation Co. regarding the Lehigh.

With navigation on the canals to be opened up shortly, the Pennsylvania R.R. purposes to displace mule towage of boats this year with the use of small power craft. This is expected to accelerate greatly the movement of traffic through the canal and to result in shipments traversing the entire length of the Delaware & Raritan waterway in 24 hours instead of several days.

The Bourse has appealed to all shippers to divert as much of their freight as possible to the canals and thus aid the railroads, upon which the Government has first call, in expediting rail traffic.

Bruce Anderson Takes a Hand in Uncle Sam's Big Job

Bruce Anderson, secretary of the Ideal Engine Co., of Lansing, Mich., and well known to concrete mixer manufacturers, contractors and builders throughout the country, is a first lieutenant in the regular army and expects to leave soon for France.

Lieutenant Anderson, who is a son-in-law of R. E. Olds, automobile manufacturer of Lansing, was one of the first to offer his services to his country after the declaration of war with Germany. He entered the officers' training school at Fort Sheridan, Ill., and upon being commissioned a first lieutenant was ordered to Fort Sam Houston, at San Antonio, Texas.

LIEUT. BRUCE ANDERSON

Lieutenant Anderson is an officer in Quartermaster's Machine Repair Shop No. 304, and the experience he gained during the years he was an executive of the Ideal Engine Co. makes valuable the work he is doing now.

Munitions Supply Centered in Baruch

Powers To Be Extended to Minister of Munitions, Is Rumor, if Overman Bill Passes

In making Bernard M. Baruch chairman of the War Industries Board on Tuesday, the President indicated by letter an intention to center in the board all control of purchases for this government and our allies, without, however, discarding the present mechanism of the various purchasing branches of the administration. It is reported that, while Mr. Baruch is technically in an advisory position at present, he will be given full executive authority when the Overman bill becomes law. This, it is pointed out, would make him for all practical purposes a minister of munitions.

Extracts from President Wilson's letter defining the duties of the rejuvenated War Industries Board and of its new chairman follow:

"The functions of the board should be:

"1. The creation of new facilities and disclosing, if necessary, the opening up of new or additional sources of supply.

"2. The conversion of existing facilities, where necessary, to new uses.

"3. The studious conservation of resources and facilities by scientific, commercial and industrial economies.

"4. Advice to the several purchasing agencies of the Government with regard to the price to be paid.

"5. The determination, wherever necessary, of priorities of production and of delivery and of the proportions of any given article to be made immediately accessible to the several purchasing agencies when the supply of that article is insufficient, either temporarily or permanently.

"6. The making of purchases for the Allies.

"The duties of the chairman are:

"1. To act for the joint and several benefit of all the supply departments of the Government.

"2. To let alone what is being successfully done and interfere as little as possible with the present normal processes of purchase and delivery in the several departments.

"3. To guide and assist wherever the need for guidance or assistance may be revealed; for example, in the allocation of contracts, in obtaining access to materials in any way preempted, or in the disclosure of sources of supply.

"4. To determine what is to be done when there is any competitive or other conflict of interest between departments in the matter of supplies.

"5. To see that contracts and deliveries are followed up where such assistance as is indicated under 3 and 4 above has proved to be necessary.

"In brief, he should act as the general eye of all supply departments in the field of industry."

BUSINESS NOTES

George McCarron, who was formerly in charge of the concrete mixer department of the F. C. Austin Co., Inc., in New York, has returned to this territory. For several years Mr. McCarron has represented the Austin Co. in Portland, Ore., and Chicago. His friends in New York welcomed him back to his old field on Jan. 1.

Chester W. Larner announces the incorporation of the Larner-Johnson Valve and Engineering Co., Widener Building, Philadelphia. This company has acquired exclusive rights for the Johnson hydraulic valve, Johnson differential surge tank and other hydraulic specialties. The Johnson valves will be manufactured for this company exclusively by the Wellman-Seaver-Morgan Co., Cleveland, Ohio.

Amplex, Incorporated, is the name of an export company just organized by Felix F. Weiner to represent American manufacturers in Japan and the Far Eastern markets. The company is interested in obtaining the accounts of manufacturers of standardized steel buildings and structural steel.

Crushed Rock Association Formed

In order to coöperate effectively with the Federal and state Governments, the crushed-stone industries of the country recently organized the National Crushed Stone Association. Officers were elected as follows: President, A. J. Blair, treasurer and general manager of Lake Shore Stone Co., Milwaukee, Wis.; first vice president, S. M. Hall, manager of the Mount Pleasant Stone Co., Mount Pleasant, Iowa; second vice president, John Rice, president of the General Crushed Stone Co., Easton, Penn.; treasurer, A. J. Sullivan, vice-president of the United States Crushed Stone Co., Chicago, Ill.; secretary, N. C. Rockwood, editor of *Rock Products*, 538 South Clark St., Chicago.

Six state organizations have been formed as auxiliaries of the association, and twelve more, including one in Canada, are being formed. Headquarters of the national body are in Chicago.

Goodwin Car Co. Changes Hands

The entire plant, equipment and assets of the Goodwin Car Co., manufacturers of steel cars, were sold at public auction to Thomas M. Voyle, of Scranton, Penn., for $350,000. This bid was submitted at the auction with the inventory of the property. The plant is located at Clearing, Ill. It is understood that the new owners will continue the operation of the plant.

Prices Stationary with Government Work Heavy

War Work Continues to Take Up Stock in Private Building Construction—Strong Demand for Lumber—Money Rates May Tighten

Government financing, including the large issues of treasury notes and the coming war loan, have made money for private building construction exceedingly scarce, manufacturing investments being apparently better taken care of by the banks than real estate investments. In spite of the resulting decline by almost fifty per cent. of city building operations, construction material prices are holding firm on the strength of work for the Federal Government. There have been increases all over the country in gravel and crushed-stone prices, and gravel is no longer quoted in New York because the demand for war work apparently exceeds the supply. The enormous purchases of lumber for war work are having their effect in raising prices. Lumber manufacturers report that demand and shipments are running well ahead of production, so that stocks are being reduced while orders are putting pressure on the mills for maximum output.

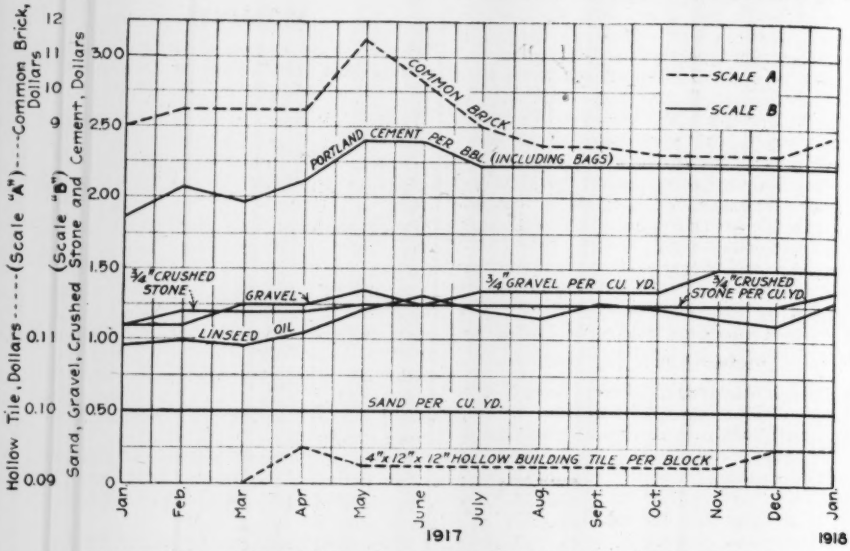
The reason for all these things, in the face of the reduction of building work, is apparent from recent total figures of contracts let in the northeastern quarter of the country, which during the past two months were valued at 60% more than in 1917, 115% more than in 1916 and about 205% more than in 1915.

Nor is there reason to doubt that other sections of the country are less active. Business in the South and West is far more active than at this time last year, according to general statistics, and these sections likewise are occupied with a great deal of war work.

The failure situation has improved generally, but especially in the West and South, in spite of increasing rates of interest. This was not altogether expected in view of the feeling that more necessary industries must be taken care of perhaps at the expense of others, and that time loans are likely to break through 6%. It is, perhaps, indication of widespread care in business management.

The labor situation on construction work continues difficult with high wages prevailing on rush contracts and labor difficult to keep on ordinary work. It is reported that the subway work in New York City now employs but 7000 men as against 12,000 last April, and that the reduction is only partly due to the completion of a number of the larger contracts.

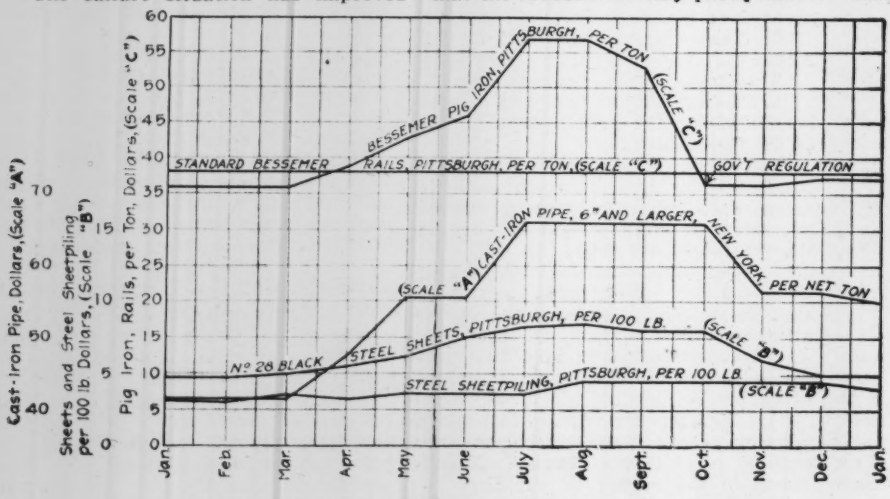
The present even course of prices, as indicated in the charts, is due in large part to price regulation. This corresponds with close approximation to the recent course of commercial price indices. There is no telling, however, whether the continuing gradual inflation of money and credit will force a readjustment and these prices will break through present upper limits.


Hollow Tile, Dollars ----- (Scale "A") ----- Common Brick, Dollars
Sand, Gravel, Crushed Stone and Cement, Dollars (Scale "B")
SCALE A
SCALE B
COMMON BRICK
PORTLAND CEMENT PER BBL (INCLUDING BAGS)
3/4" CRUSHED STONE
GRAVEL
LINSEED OIL
3/4" GRAVEL PER CU. YD.
3/4" CRUSHED STONE PER CU. YD.
SAND PER CU. YD.
4" x 12" x 12" HOLLOW BUILDING TILE PER BLOCK
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec Jan
1917
1918

PRINCIPAL CONSTRUCTION MATERIALS HOLD AT HIGH LEVELS

Chambers of Commerce to Discuss Wartime Readjustments

Business readjustment to war will be the dominant note of the sixth annual meeting of the United States Chamber of Commerce. The four critical questions of the day—financing the war, railroads, centralized control of industry and shipping—will be considered from the twofold point of view of filling the Government requirements with least disturbance to industry.


Cast-Iron Pipe, Dollars, (Scale "A")
Sheets and Steel Sheetpiling per 100 lb Dollars, (Scale "B")
Pig Iron, Rails, per Ton, Dollars, (Scale "C")
BESSEMER PIG IRON, PITTSBURGH, PER TON (SCALE "C")
STANDARD BESSEMER RAILS, PITTSBURGH, PER TON, (SCALE "C")
GOV'T REGULATION
CAST-IRON PIPE, 6" AND LARGER, NEW YORK, PER NET TON (SCALE "A")
No 28 BLACK STEEL SHEETS, PITTSBURGH, PER 100 LB. (SCALE "B")
STEEL SHEETPILING, PITTSBURGH, PER 100 LB. (SCALE "B")
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec Jan

STEEL PRODUCTS SHOW REGULATION BY GOVERNMENT

War Work Moves Swiftly Under Cleveland Commission

War work in Cleveland is progressing smoothly and swiftly under the campaign of coördination supervised by the Cleveland War Industries Commission. Several thousand manufacturing plants in the Cleveland district are being welded into an organized unit.

It is planned to establish Government offices in charge of capable men with authority to bring manufacturers and Government in contact on war work.

Exportation of Scrap Iron

The War Trade Board calls attention to the fact that the exportation of scrap iron or steel requires an export license.